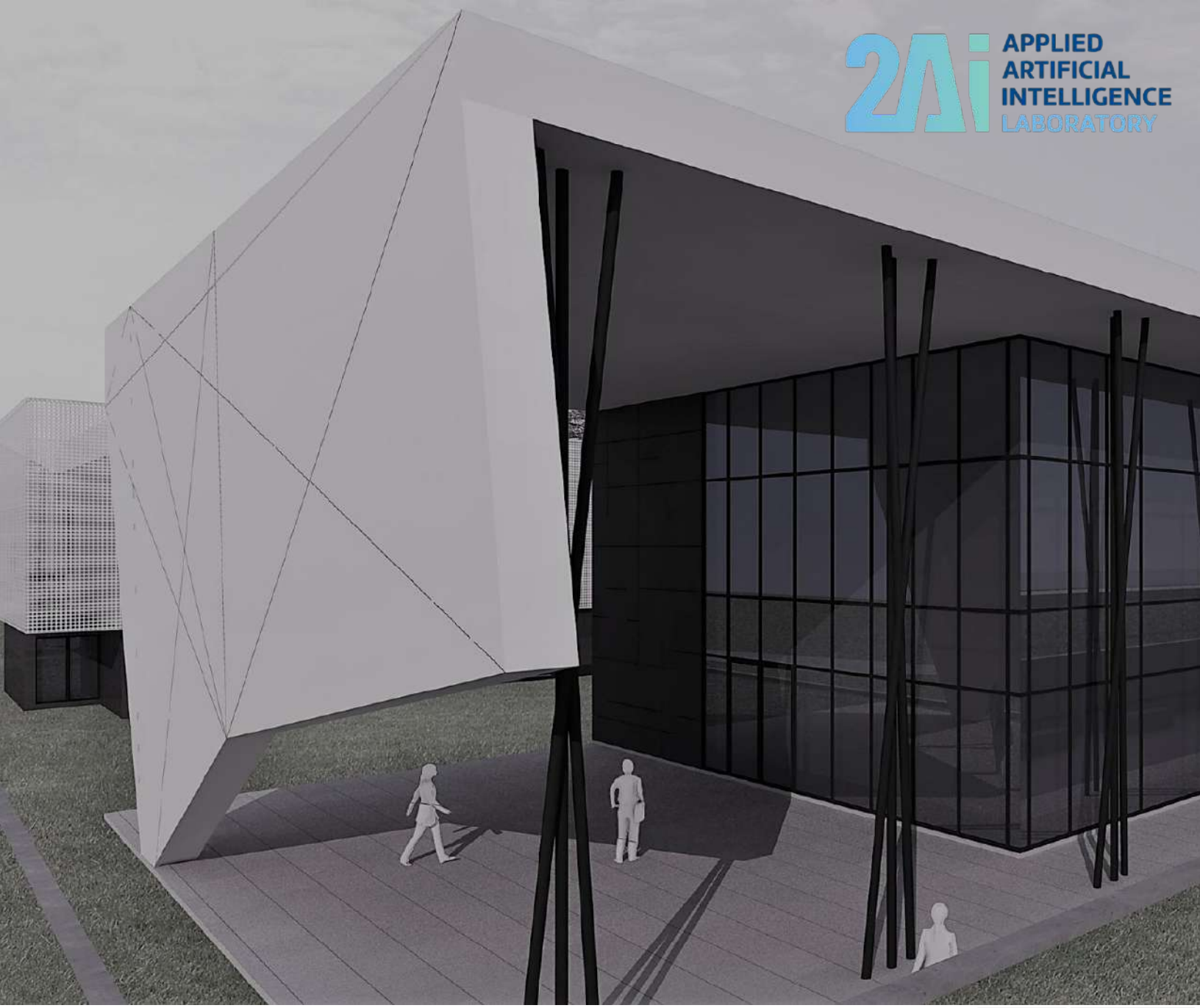


2AI - APPLIED ARTIFICIAL INTELLIGENCE LABORATORY

ACTIVITIES REPORT 2022

INDEX

1. INTRODUCTION

The R&D Unit Applied Artificial Intelligence Laboratory (2Ai) was created in the Polytechnic Institute of Cávado and Ave (IPCA) in 2018. In January 2020, 2Ai received the Very Good classification by FCT (on a scale of Not recognized, Weak, Good, Very Good and Excellent). It pursues applied research advances on artificial intelligence (AI), namely in intelligent systems, human-AI Collaboration and robotics for health, industry, environment and security. This cross-cutting themes and multidisciplinary interface fosters the generation of value through the development of innovative products and smart services, resulting from internationally highly competitive research.

2Ai is a fully incorporated research structure within the School of Technology (EST) of IPCA. 2Ai is a research unit within the young and innovative EST, guided by values of excellence and proximity at the regional level. The research center is composed of a young group of 16 integrated members with Ph.D., and most of their members have received a Ph.D. degree in the last 10 years.

2. OBJECTIVES AND AIMS

The 2Ai scientific vision focuses on augmenting the knowledge, information and interaction at the disposal of agents, robots and humans to improve their performance at the target areas. To this end, we aim to apply machine learning techniques, spanning natural language processing, deep-learning and computer vision, to extract information and provide knowledge to potentiate intelligent decision automation systems and human-AI collaboration. 2Ai will also strongly focus on the application of gamification concepts as an engine for the development of new smart and personalized training approaches. Furthermore, the search for more natural interfaces to improve the overall control of the context environment will complete an integrated suite of research efforts, on the path towards innovative technologies and smarter services.

The creation of this type of solutions can generate new markets, and improve efficiency of existing goods and services across the 2Ai impact areas:

Healthcare: The development of novel AI services aiming to provide innovative decision support systems for improved medical diagnoses. It also has potential to improve telemedicine, assist in repetitive medical tasks and enhance smart surgical rooms with robots, natural user interfaces, and augmented reality setups by combining different image sources. Additionally, smart data analysis strategies will be pursued as a key factor in order to better correlate illness evolution to their treatment. In the long-term, the goal is to provide more efficient pipelines to promote proactive and personalized clinical services.

Industry: AI services to increase production capabilities through more reliable forecast of market demand, increased flexibility in operations and the supply chain and equipment failure prediction will drive this research area. By applying these solutions, smarter, faster, cheaper production approaches are expected. Furthermore, the application of game-based learning tools, with virtual and augmented reality, collaborative robots and smart virtual assistants are expected to improve productivity and the employees' health and safety.

Environment and security: AI services, combining aerial robots and artificial vision, to perform a smart monitoring of natural environments (e.g., forests) will be pursued. These AI services can gather site-specific and timely data about different dynamic aspects of the environment, generate warnings only when and where they are needed, and create a historical record of the environment. AI can also assist in the supervision and detection of anomalous conditions, providing situational awareness for a broad range of monitoring services. Distributed sensor systems complemented with AI can further increase pattern understanding of normal conditions, and detect when the probability of change rises significantly, whether triggered by natural or human causes.

In order to fulfill these aims, 2Ai defined a research plan focused on the following main strategies:

(S1) - Research and development of novel and effective methods for innovative services applied to the 2Ai impact areas;

(S2) - Development of shared public databases and prototyping tools for AI training, testing and validation;

(S3) - Study the regional and national landscape to foster a sustainable and healthy AI R&D ecosystem, combining academia, industry and experts;

(S4) - Prototype systems as proof-of-concepts leading to the creation of intelligent services and applications, enhance the translation of new tools and promote innovation through the creation and nurturing of new SMEs and spin-offs;

(S5) - Contribute to the creation of a critical mass of highly skilled human resources in AI by attracting and collaborating with leading researchers, entrepreneurs, and experts active in the field;

(S6) - Attraction of funds and investors for research.

2.1 MAIN ACHIEVEMENTS DURING THE YEAR OF 2022

According to the defined strategic plan, the following achievements were obtained in 2022.

STRATEGIC AIM	OUTCOMES
S1	Leveraged by its scientific development during its initial years, 2Ai achieved excellent scientific outputs throughout 2022, obtaining its top results since the initial proposal in 2018. In 2022, a total of 27 international journal publications (24 in peer-review journals (ISI indexed)), 59 proceedings in international conferences, 20 proceedings in national conferences, 3 book chapters and 5 patents were published. This represents an average of 5,4 publications per integrated researcher. From the published works (ISI indexed peer-review journals), 91,7% of the studies were included in top-rank journals (Q1 and Q2). Particularly, 29,2% Q1 and 62,5% Q2 journals publications were obtained. In comparison to 2021, it was registered an increase of 50% and 32,6% in the number of journal publications and the total number of conference proceedings, respectively. Concerning the scope of each

	publication, a total of 13 international publications (~48% of all publications) were recognized as first or senior author. Concerning its research philosophy, it was again pursue the intellectual property protection through patents, including conversion of provisional patents in international ones. In detail, in 2022, 2 international patents, 1 European patent and 2 provisional patents were submitted. Most of the research outputs were performed in collaboration with other European R&D centers, such as: Physics Center of University of Minho (Portugal), Algoritmi Research Center of University of Minho, (Portugal), LIACC of Faculty of Engineering of the University of Porto (Portugal) Saxony Center for Feto-Neonatal Health (Dresden, Germany), ICVS/3B's - PT Government Associate Laboratory (Braga/Guimarães, Portugal), Department of Pediatric Surgery, Hospital of Braga (Braga, Portugal), Psychological Neuroscience Lab, Centro de Investigação em Psicologia (CIPsi), School of Psychology, University of Minho (Braga, Portugal), MEtRICs Research Centre, School of Engineering, University of Minho (Guimaraes, Portugal), 2C2T Research Centre, School of Engineering, University of Minho (Guimaraes, Portugal), Center for Research and Development in Mathematics and Applications (CIDMA), Department of Mathematics, University of Aveiro (Aveiro, Portugal), proMetheus, Instituto Politécnico de Viana do Castelo (Viana do Castelo, Portugal), Laboratory of Physics for Materials and Emergent Technologies, LapMET, University of Minho, (Braga, Portugal), Chemistry Centre of University of Minho (Braga, Portugal), Institute of Science and Innovation for Bio-Sustainability (IB-S), University of Minho (Braga, Portugal), BCMaterials, Basque Center for Materials, Applications and Nanostructures, UPV/EHU Science Park (Leioa, Spain), Department for Neonatology and Pediatric Intensive Care Medicine of University Hospital Carl Gustav Carus (Dresden, Germany), Universitätsklinikum Bonn (Bonn, Germany), The Chinese University of Hong Kong (Hong Kong, China), and Lab on Cardiovascular Imaging and Dynamics, KU Leuven (Belgium), demonstrating the good research network of 2Ai members. Moreover, a policy of fostering an active involvement of students within the 2Ai research projects was pursued, through 24 completed bachelor projects and 22 master students.
S2	Focused on the development of AI methodologies, 4 public databases, 4 mathematical models, 7 computational applications, and 5 laboratory prototypes were released in 2022. To promote good scientific practices, through open sciences politics, all databases are publicly released under request. Moreover, under this last year, 2AI pursued its participation in international benchmarks/challenges to compare the performance of the developed AI systems against other state-of-the-art solutions.
S3	In line with the previous years, 2Ai actively pursued a sustainable and healthy AI R&D ecosystem, combining academia, industry, and experts. Under the scientific point of view, 2Ai members organized a total of 13 international conferences/symposiums targeting 2Ai related impact areas. Moreover, through the European project RUN-EU+, 2Ai focused on the design and implementation of a Researcher Career Development Training Programme, aiming to train young and senior researchers, as well as supervisors to scientific excellence. At a regional level, and in line with the previous year, 2Ai organized again a set of events in collaboration with other R&D units in the north of Portugal, namely the regular webinars "Talk for Us" and the 2nd edition of the Symposium of Applied Science for Young

	Researchers (SASYR), which has for the first time organized in a hybrid format (with presential reception in the Polytechnic Institute of Viana do Castelo). Moreover, the individual open sessions promoted by the 2Ai integrated members, "2Ai Talks", were organized, being promoted the participation of all researchers, academic community and relevant industrial players of the region. Internally, and targeting the training of young researchers, 2Ai continued to promote the weekly sessions titled "2Ai Journal Club". Aiming to promote the discussion between all stakeholders on 2Ai researchers, as well as, to recognize the main industrial partners in the current scientific projects, 2Ai organized for the first the "Open Day Indústria". All industrial partners, as well as, scientific and innovation national associations (National Agency of Innovation) were evolved in this discussion. Moreover, this session also worked as a relevant demonstration scenario to present 2Ai laboratories and all ongoing projects to the different regional stakeholders.
S4	Following the national strategy for the resilience recovery program, 2Ai actively collaborated with different industrial partners for the implementation of innovative co-promotion projects with direct impact on the national economy until 2025. Therefore, 2Ai successfully integrated two consortiums (one targeting medical solutions and a second focused on industry), with a funding of ~2M€, aiming to collaborate with already established industries or start-ups to accelerate the construction and release of new products. In line with the previous years, 2Ai kept its strong effort to protect the intellectual property through patents (5 patents in 2022). Most of the submitted patents were applied for international protection.
S5	2Ai offered a set of advanced courses for training in emergent technological areas, namely Fundamentals of VFX in Foundry Nuke, Applied Cybersecurity, Deep Learning for Computer Vision, Data Analysis and Affective Computing. The advanced course "Data Analysis" took place in the week between 21 and 25 November, 2022, and was attended by participants from 2 European countries (Poland and Lithuania). The new PhD program in Games and Creative Technologies, collaboration between the European University and 2Ai/IPCA, started its first edition in September with a total of 7 students. Moreover, 2Ai/IPCA has accredited a new master program entitled "Professional Master in STEAM Technology". Under the RUN-EU, 2Ai members organized two Short Advanced Programs. Moreover, 2Ai members are committed to define a set of guidelines targeting scientific careers, as well as, identifying the relevant basis for the implementation of common professional PhD and Master programs. 2Ai also pursued the expansion of its research team, offering a set of research position, in different categories (bachelor, master and post-doctoral researchers). Moreover, 2Ai guaranteed external funding by our national science and open a position for a PhD researcher in scientific career.
S6	A total of 15 projects were submitted in 2022 targeting national, industrial cooperation and European calls. Only in 2022, a total amount of 2.146.922,16€ was collected in 5 accepted projects, representing an increase of 134% in relation to the previous report. Moreover, for the first time since its creation, 2Ai participated in a project directly funded by the national agency for science and technology through the general call for project. The achieved funding corresponds to an average of ~134k€ raised per integrated member. During 2022, 2Ai

	members kept its straight collaboration with industry, performing a total of 3 external services to industry, with a total private funding of 56.135,95€. Overall, 2Ai currently has 21 projects ongoing with total funding of >6M€ (2020-2025). Additionally, 2Ai members are currently principal investigators in relevant institutional projects, aiming to implement the future basis of research and innovation in IPCA, with a funding of >6M€ .

A summary of the scientific outcomes obtained by the 2Ai members is presented in Table 1. The outcomes are presented according to the standard guidelines of the Portuguese Foundation for Science and Technology (FCT).

Table 1 - Summary of the 2Ai' scientific outcomes

SCHOLARSHIP	Nº OF POSITIONS
A. Publications	
A1. Books / Book Chapters	3
A2. Scientific Publications in International Journals	27
A3. Scientific Publications in National Journals	1
B. Conferences	
B1. Proceedings in International Conferences	59
B2. Proceedings in National Conferences/abstracts	20
C. Reports	1
D. Organization of conferences	13
E. Advanced Training	
E1. PhD Thesis	0
E2. Master Thesis	23
E3. Bachelor final projects	24
F. Mathematical Models	4
G. Computational applications	7
H. Pilot Installations	0
I. Laboratorial Prototypes	5
J. Patents / Provisional Patents	5

3. PRODUCTIVITY

3.1 PUBLICATIONS IN PEER-REVIEW JOURNALS

1. Torres, H.T, Oliveira, B., Morais, P., Fritze, A. Rüdiger, M., Fonseca, J.C. and Vilaça, J.L. (2022). Realistic 3D infant head surfaces augmentation to improve AI-based diagnosis of cranial deformities. *Journal of Biomedical Informatics*. DOI: https://doi.org/10.1016/j.jbi.2022.104121 1. *(ISI indexed journal: IF: 8.000; Q:Q1; Scopus indexed journal; Scimago (SJR): Q:Q1)*

2. Torres, H.R., Morais, P., Fritze, A., Burkhardt, W., Kaufmann, M., Oliveira, B., Veloso, F., Hahn, G., Rüdiger, M, Fonseca, J.C and Vilaça, J.L. (2022). Anthropometric Landmarking for Diagnosis of Cranial Deformities: Validation of an Automatic Approach and Comparison with Intra- and Interobserver Variability. *Annals of Biomedical Engineering (2022)*. DOI: https://doi.org/10.1007/s10439-022-02981-6 *(ISI indexed journal: IF: 4.219; Q:Q2; Scopus indexed journal; Scimago (SJR): Q:Q2)*

3. Torres, H. R., Morais, P., Oliveira, B., Birdir, C., Rüdiger, M., Fonseca and J. C., Vilaça, J.L. (2022). A review of image processing methods for fetal head and brain analysis in ultrasound images. *Computer Methods and Programs in Biomedicine*. DOI: https://doi.org/10.1016/j.cmpb.2022.106629 *(ISI indexed journal: IF: 7.027; Q:Q1; Scopus indexed journal; Scimago (SJR): Q:Q1)*

4. Gharleghi, R., Adikari, D., Ellenberger, K., Sze-Yuan Ooi, Ellis, C., Chung-Ming Chen, Gao, R., He, Y., Hussain, R., Chia-Yen Lee, Li, J., Ma, J., Nie, Z., Oliveira, B., Qi, Y., Skandarani, Y., Vilaça, J.L., Wang, X., Yang, S., Sowmya, A. and Beier, S. (2022). Automated segmentation of normal and diseased coronary arteries – The ASOCA challenge. *Computerized Medical Imaging and Graphics*. DOI: https://doi.org/10.1016/j.compmedimag.2022.102049 *(ISI indexed journal: IF: 7.422; Q:Q1; Scopus indexed journal; Scimago (SJR): Q:Q1)*

5. Veloso, F., Miranda, D., Morais, P., Torres, H. R., Oliveira, B., Correia-Pinto, J., C.M. Pinho, A. and Vilaça, J.L. (2022). Study of the compression behavior of functionally graded lattice for customized cranial remodeling orthosis. *Journal of the Mechanical Behavior of Biomedical Materials*. DOI: https://doi.org/10.1016/j.jmbbm.2022.105191 *(ISI indexed journal: IF: 4.042; Q:Q2; Scopus indexed journal; Scimago (SJR): Q:Q2)*

6. Melo, C., Dixe, S., Fonseca, J.C., Moreira, A.H.J. and Borges, J. (2022). AI Based Monitoring of Different Risk Levels in COVID-19 Context. *Sensors 2022*. DOI: https://doi.org/10.3390/s22010298 *(ISI indexed journal: IF: 3.847; Q:Q1; Scopus indexed journal; Scimago (SJR): Q:Q1)*

7. Ramos, D., Fonseca, L., Gonçalves, J., Carvalho, R., Carvalho, S. and Santos, G. (2022). Cost-Benefit Analysis of Implementing Circular Economy in a Portuguese Company: From a Case Study to a Model. *Quality Innovation Prosperity*. DOI: https://doi.org/10.12776/qip.v26i1.1657 *(ISI indexed journal: IF: NA; Q:Q3; Scopus indexed journal; Scimago (SJR): Q:Q2)*

8. Silveira, A., Sequeira, T., Gonçalves, J. and Ferreira, P.L. (2022). Patient reported outcomes in oncology: changing perspectives—a systematic review. *Health and Quality of Life Outcomes* 20, 82 (2). DOI: https://doi.org/10.1186/s12955-022-01987-x *(ISI indexed journal: IF: 3.077; Q:Q2; Scopus indexed journal; Scimago (SJR): Q:Q1)*

9. Morais, P., Nelles, D., Vij, V., Al-Kassou, B., Weber, M., Nickenig, G., Schrickel, JW., Vilaca, J.L. and Sedaghat, A. (2022). Assessment of LAA Strain and Thrombus Mobility and Its Impact on Thrombus

Resolution—Added-Value of a Novel Echocardiographic Thrombus Tracking Method. *Cardiovascular Engineering and Technology*. DOI: https://doi.org/10.1007/s13239-022-00629-z *(ISI indexed journal: IF: 2.305; Q:Q2; Scopus indexed journal; Scimago (SJR): Q:Q2)*

10. Gomes, P., Brusca, I., Fernandes, M.J. and Vilhena, E. (2022). The IPSAS implementation and the use and usefulness of accounting information: a comparative analysis in the Iberian Peninsula. *Journal of Public Budgeting, Accounting & Financial Management*. DOI: https://doi.org/10.1108/JPBAFM-12-2021-0169 *(Not ISI indexed journal: IF: NA; Q:NA; Scopus indexed journal; Scimago (SJR): Q:Q1)*

11. Varela, L., Ávila, P., Castro, H., Putnik, G.D., Fonseca, L.M.C., Ferreira, L. (2022). Manufacturing and Management Paradigms, Methods and Tools for Sustainable Industry 4.0-Oriented Manufacturing Systems. *Sustainability 2022*. DOI: https://doi.org/10.3390/su14031574 *(ISI indexed journal: IF: 3.889; Q:Q2; Scopus indexed journal; Scimago (SJR): Q:Q1)*

12. Reis, J.V., Vieira, R., Portugal-Nunes, C., Coelho, A., Magalhães, R., Moreira, P., Ferreira, S., Picó-Pérez, M., Sousa, N., Dias, N. and Bessa, JM. (2022). Suicidal Ideation Is Associated With Reduced Functional Connectivity and White Matter Integrity in Drug-Naïve Patients With Major Depression. *Front Psychiatry*. DOI: https://doi.org/10.3389/fpsyt.2022.838111 *(ISI indexed journal: IF: 5.435; Q:Q2; Scopus indexed journal; Scimago (SJR): Q:Q1)*

13. Ferreira, R., Matos, D., Carvalho, V. and Soares, F. (2022). A platform toy for children with special educational needs. *Journal of Accessibility and Design for All*, Vol.12, pp.1-25. DOI: https://doi.org/10.17411/jacces.v12i1.250 *(Not ISI indexed journal: IF: NA; Q:NA; Scopus indexed journal; Scimago (SJR): Q:Q2)*

14. Fadlelmoula, A., Pinho, D., Carvalho, V., Catarino, S.O. and Minas, G. (2022). Fourier Transform Infrared (FTIR) Spectroscopy to Analyse Human Blood over the Last 20 Years: A Review towards Lab-on-a-Chip Devices. *Micromachines*, Vol.13, pp.1-20. DOI: https://doi.org/10.3390/mi13020187 *(ISI indexed journal: IF: 3.523; Q:Q2; Scopus indexed journal; Scimago (SJR): Q:Q2)*

15. Silva, J., Lopes, N., Curado, A., Nunes, L.J.R. and Lopes, S.I. (2022). A pre-diagnosis model for radon potential evaluation in buildings: A tool for balancing ventilation, indoor air quality and energy efficiency. *Energy Reports*, Vol. 8, pp. 539-546. DOI: https://doi.org/10.1016/j.egyr.2022.02.100 *(ISI indexed journal: IF: 4.937; Q:Q2; Scopus indexed journal; Scimago (SJR): Q:Q1)*

16. Nunes, L.J.R., Curado, A., Azevedo, R., Silva, J.P., Lopes, N. and Lopes, S.I. (2022). Designing a Multicriteria WebGIS-Based Pre-Diagnosis Tool for Indoor Radon Potential Assessment. *Applied Sciences 2022*, 12, 1412. DOI: https://doi.org/10.3390/app12031412 *(ISI indexed journal: IF: 2.838; Q:Q2; Scopus indexed journal; Scimago (SJR): Q:Q2)*

17. Dias, A.M., Carvalho, A.M. and Sampaio, P. (2022). Quality 4.0: literature review analysis, definition and impacts of the digital transformation process on quality. *International Journal of Quality & Reliability Management*, Vol. 39 No. 6, pp. 1312-1335. DOI: https://doi.org/10.1108/IJQRM-07-2021-0247 *(ISI indexed journal: IF: NA; Q:Q3; Scopus indexed journal; Scimago (SJR): Q:Q2)*

18. Marques, P.A., Carvalho, A.M. and Santos, J.O. (2022). Improving Operational and Sustainability Performance in a Retail Fresh Food Market Using Lean: A Portuguese Case Study. *Sustainability 2022*, 14, 403. DOI: https://doi.org/10.3390/su14010403 *(ISI indexed journal: IF: 3.889; Q:Q2; Scopus indexed journal; Scimago (SJR): Q:Q1)*

19. Roth HR, Xu Z, Tor-Díez C, Sanchez Jacob R, Zember J, Molto J, Li W, Xu S, Turkbey B, Turkbey E, Yang D, Harouni A, Rieke N, Hu S, Isensee F, Tang C, Yu Q, Sölter J, Zheng T, Liauchuk V, Zhou Z, Moltz JH, Oliveira B, Xia Y, Maier-Hein KH, Li Q, Husch A, Zhang L, Kovalev V, Kang L, Hering A, Vilaça JL, Flores M, Xu D, Wood B. and Linguraru MG. (2022). Rapid artificial intelligence solutions in a pandemic-The COVID-19-20 Lung CT Lesion Segmentation Challenge. *Medical Image Analysis* 2022. DOI: https://doi.org/10.1016/j.media.2022.102605 *(ISI indexed journal: IF: 13.828; Q:Q1; Scopus indexed journal; Scimago (SJR): Q:Q1)*

20. Oliveira, B., Morais, P., Torres, H.R., Baptista, A.L., Fonseca, J.C. and Vilaça, J.L. (2022). Characterization of the Workspace and Limits of Operation of Laser Treatments for Vascular Lesions of the Lower Limbs. *Sensors* 2022. DOI: https://doi.org/10.3390/s22197481 *(ISI indexed journal: IF: 3.847; Q:Q1; Scopus indexed journal; Scimago (SJR): Q:Q1)*

21. Veloso, F., Gomes-Fonseca, J., Morais, P., Correia-Pinto, J., Pinho, A.C. and Vilaça, J.L. (2022), Overview of Methods and Software for the Design of Functionally Graded Lattice Structures. *Adv. Eng. Mater*., 24:2200483. DOI: https://doi.org/10.1002/adem.202200483 *(ISI indexed journal: IF: 4.122; Q:Q2; Scopus indexed journal; Scimago (SJR): Q:Q1)*

22. Santos, D. and Simões, A.. (2022). Clustering emotions in Portuguese. *Journal of Portuguese Linguistics*, 21:1-33. DOI: https://doi.org/10.16995/jpl.8197 *(ISI indexed journal: IF: NA; Q:Q2; Scopus indexed journal; Scimago (SJR): Q:Q2)*

23. Carqueijó, S., Ramos, D., Gonçalves, J., Carvalho, S., Murmura, F., Bravi, L., Doiro, M., Santos, G. and Zgodavová, K. (2022). The Importance of Fab Labs in the Development of New Products toward Mass Customization. *Sustainability* 2022. DOI: https://doi.org/10.3390/su14148671 *(ISI indexed journal: IF: 3.889; Q:Q2; Scopus indexed journal; Scimago (SJR): Q:Q1)*

24. Caixeta, F., Carvalho, A.M., Saraiva and P., Freire, F. (2022). Sustainability-Focused Excellence: A Novel Model Integrating the Water–Energy–Food Nexus for Agro-Industrial Companies. *Sustainability* 2022. DOI: https://doi.org/10.3390/su14159678 *(ISI indexed journal: IF: 3.889; Q:Q2; Scopus indexed journal; Scimago (SJR): Q:Q1)*

25. Silva, I., Jólluskin, G., Vilhena, E. and Byrne, A. (2022). Adaptation of the Pet Bereavement Questionnaire for European Portuguese Speakers. *International Journal of Environmental Research and Public Health*, 20(1):534. DOI: https://doi.org/10.3390/ijerph20010534 *(ISI indexed journal: IF: 4.614; Q:Q1; Scopus indexed journal; Scimago (SJR): Q:Q1)*

26. Pereira, F., Macedo, A., Pinto, L., Soares, F., Vasconcelos, R., Machado, J. and Carvalho, V. (2022). Intelligent Computer Vision System for Analysis and Characterization of Yarn Quality. *Electronics,* 12(1):236. DOI: https://doi.org/10.3390/electronics12010236 *(ISI indexed journal: IF: 2.690; Q:Q2; Scopus indexed journal; Scimago (SJR): Q:Q2)*

27. Mendes, A., Duque, D. and Carvalho, V. (2022). Development of a Virtual Reality Tool for Therapy and Diagnosis of Schizophrenia. *Sensors & Transducers Journal*, Vol. 259, Issue 5, pp.37-44. *(Not ISI indexed journal: IF: NA; Q:NA; Scopus indexed journal; Scimago (SJR): Q:Q4)*

3.2 SCIENTIFIC PUBLICATIONS IN NATIONAL JOURNALS

1. Ferreira,L. (2022). Opinion article: Head in the clouds.... one-way trip to the Technological Singularity. *País Positivo*, edition 151, pp. 11. *(Not ISI indexed journal: IF: NA; Q:NA; Not Scopus indexed journal; Scimago (SJR): Q:NA)*

3.3 SCIENTIFIC PUBLICATIONS IN INTERNATIONAL CONFERENCES

1. Simões, A. and Salgado, A. (2022). Smart dictionary editing with LeXmart. In *XX EURALEX international congress*. URL: https://ambs.zbr.pt/publications/euralex22.pdf *(ISI/Scopus indexed International Conference Paper)*

2. Cunha, L. F., Almeida, J.J. and Simões, A. (2022). Reasoning with Portuguese word embeddings. In *11th Symposium on Languages, Applications and Technologies (SLATE 2022)*, Vol.104, Open Access Series in Informatics (OASIcs), pp 17:1--17:14. Schloss Dagstuhl -- Leibniz-Zentrum für Informatik. DOI: https://doi.org/10.4230/OASIcs.SLATE.2022.17 *(ISI/Scopus indexed International Conference Paper)*

3. Simões, A. and Almeida, J. J. (2022). Down-translating XML: The Python way. In *11th Symposium on Languages, Applications and Technologies (SLATE 2022)*, Vol. 104, Open Access Series in Informatics (OASIcs), pp. 15:1--15:9. Schloss Dagstuhl -- Leibniz-Zentrum für Informatik. URL: https://drops.dagstuhl.de/opus/volltexte/2022/16761/pdf/OASIcs-SLATE-2022-15.pdf *(ISI/Scopus indexed International Conference Paper)*

4. Morais, P., Nelles, D., Wilko Schrickel, J., Nickenig, G., D'hooge, J., Sedaghat, A. and Vilaça, J.L. (2022). 3D segmentation of the left atrial appendage in computed tomography for planning of transcatheter occlusion. In *SPIE Medical Imaging*, 2022, San Diego, California, United States. DOI: https://doi.org/10.1117/12.2610705 *(ISI/Scopus indexed International Conference Paper)*

5. Torres, H.T., Oliveira, B., Morais, P., Fritze, A., Birdir, C., Rüdiger, M., Fonseca, J.C and Vilaça, J.L. (2022). Fetal head circumference delineation using convolutional neural networks with registration-based ellipse fitting. In *SPIE Medical Imaging*, 2022, San Diego, California, United States. DOI: https://doi.org/10.1117/12.2611150 *(ISI/Scopus indexed International Conference Paper)*

6. Antunes, A. R., Meneses, M. V. P. R., Gonçalves, J. and Braga, A. C. (2022). An Intelligent System to Detect Drowsiness at the Wheel. In *10th International Symposium on Digital Forensics and Security (ISDFS)*, 2022, pp. 1-6. DOI: https://doi.org/10.1109/ISDFS55398.2022.9800836 *(ISI/Scopus indexed International Conference Paper)*

7. Pereira, J. G. and Gonçalves, J. (2022). Human Activity Recognition: A review. In *10th International Symposium on Digital Forensics and Security (ISDFS)*, 2022, pp. 1-5, DOI: https://doi.org/10.1109/ISDFS55398.2022.9800781 *(ISI/Scopus indexed International Conference Paper)*

8. Castro, H., Pinto, N., Pereira, F., Ferreira, L., Ávila, P., Bastos, J., Putnik, G.D. and Cruz-Cunha, M. (2021). Cyber-Physical Systems using Open Design: an approach towards an Open Science Lab for

Manufacturing. In *Procedia Computer Science*, Vol. 196, pp. 381-388. DOI: https://doi.org/10.1016/j.procs.2021.12.027 *(ISI/Scopus indexed International Conference Paper)*

9. Alves, F., Mateus-Coelho, N. and Cruz-Cunha, M. (2022). ChevroCrypto – Security & Cryptography Broker. In *10th International Symposium on Digital Forensics and Security (ISDFS)*, 2022, pp. 1-5, DOI: https://doi.org/10.1109/ISDFS55398.2022.9800797 *(ISI/Scopus indexed International Conference Paper)*

10. Patrício, L. Ávila, P., Varela, L., Costa, C., Ferreira, P., Cruz-Cunha, M., Ferreira, L.P., Bastos, J. and Castro, H. (2022). Sustainable Criteria to the self-decision making of the partners regarding its integration in collaborative networks. In *Procedia Computer Science*, Vol. 196, pp. 371-380. DOI: https://doi.org/10.1016/j.procs.2021.12.026 *(ISI/Scopus indexed International Conference Paper)*

11. Barbosa, P., Cunha, P., Carvalho, V. and Soares, F. (2022). Deep Learning in Taekwondo Techniques Recognition System: A Preliminary Approach. In *Mechatronics Engineering II. (icieng 2022). Lecture Notes in Mechanical Engineering*. Springer, Cham. https://doi.org/10.1007/978-3-031-09385-2_25 *(ISI/Scopus indexed International Conference Paper)*

12. Fadlelmoula, A., Catarino, S.O., Carvalho, V., Minas, G. and Ferreira, P. (2022). Contribution of biomedical devices innovation to sustainable development goals (SDG). In *Proceedings of 5th ICEE – International Conference on Energy & Environment: Bringing together Economics and Engineering*, Porto, Portugal, 2-3 June 2022, pp. 143-148. URL: https://icee2022.fep.up.pt/bookofproceedings/ *(ISI/Scopus indexed International Conference Paper)*

13. Dias, G., Soares, F., Carvalho, V., Pereira, A., and Martins, T. (2022). Inclusive Platform: GUS for Social Inclusion and Competencies Development in Cerebral Palsy. In *Innovations in Mechanical Engineering II (icieng 2022), Lecture Notes in Mechanical Engineering*. Springer, Cham. DOI: https://doi.org/10.1007/978-3-031-09382-1_20 *(ISI/Scopus indexed International Conference Paper)*

14. Azevedo, R., Silva, J. P., Lopes, N., Curado, A., Nunes, L. J. R. and Lopes, S. I. (2022). Designing an IoT-enabled Data Warehouse for Indoor Radon Time Series Analytics. In *17th Iberian Conference on Information Systems and Technologies (CISTI)*, 2022, pp. 1-6, DOI: https://doi.org/10.23919/CISTI54924.2022.9820540 *(ISI/Scopus indexed International Conference Paper)*

15. Fernandes, R. and Lopes, N. (2022). Network Intrusion Detection Packet Classification with the HIKARI-2021 Dataset: a study on ML Algorithms. In *10th International Symposium on Digital Forensics and Security (ISDFS)*, 2022, pp. 1-5, DOI: https://doi.org/10.1109/ISDFS55398.2022.9800807 *(ISI/Scopus indexed International Conference Paper)*

16. Silva, B., Oliveira, V., Morais, P., Buschle, LR, Correia–Pinto, J., Lima, E. and Vilaça, J.L. (2022). Analysis of Current Deep Learning Networks for Semantic Segmentation of Anatomical Structures in Laparoscopic Surgery". In *44th Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC)*, 2022, pp. 3502-3505. DOI: https://doi.org/10.1109/EMBC48229.2022.9871583 *(ISI/Scopus indexed International Conference Paper)*

17. Costa, J.N, Gomes-Fonseca, J., Valente, S., Ferreira, L., Oliveira, B., Torres, H.R., Morais, P., Alves, V. and Vilaça, J.L. (2022). Ultrasound training simulator using augmented reality glasses: an accuracy and precision assessment study. *In 44th Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC)*, 2022, pp. 4461-4464. DOI:

https://doi.org/10.1109/EMBC48229.2022.9871406 *(ISI/Scopus indexed International Conference Paper)*

18. Ferreira, M.R., Torres, H.R, Oliveira, B., Gomes-Fonseca, J., Morais, P., Novais, P. and Vilaça, J.L. (2022). Comparative Analysis of Current Deep Learning Networks for Breast Lesion Segmentation in Ultrasound Images. In *44th Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC)*, 2022, pp. 3878-3881. DOI: https://doi.org/10.1109/EMBC48229.2022.9871091 *(ISI/Scopus indexed International Conference Paper)*
19. Torres, H.R, Morais, P., Fritze, A., Oliveira, B., Veloso, F, Rüdiger, M., Fonseca, J.C. and Vilaça, J.L. (2022). 3D Facial Landmark Localization for cephalometric analysis. In *44th Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC)*, 2022, pp. 1016-1019. DOI: https://doi.org/10.1109/EMBC48229.2022.9871184 *(ISI/Scopus indexed International Conference Paper)*

20. Escrivães, I., Barbosa, L.C.N., Torres, H.R., Oliveira, B., Carvalho, V., Moreira, A.H.J, Vilaça, J.L. and Morais, P. (2022). ECG classification using Artificial Intelligence: Model Optimization and Robustness Assessment. In *2022 IEEE 10th International Conference on Serious Games and Applications for Health (SeGAH)* (pp. 1-6). *(ISI/Scopus indexed International Conference Paper)*

21. Oliveira, V.M., Pereira, D., Oliveira, B., Morais, P., Oliveira, B., Duque, D., Vilaça, J.L. and Moreira, A.H.J. (2022). A Robotic and Game-Based Framework for Assisted Upper Limb Rehabilitation. In *2022 IEEE 10th International Conference on Serious Games and Applications for Health (SeGAH)* (pp. 1-6). *(ISI/Scopus indexed International Conference Paper)*

22. Duarte, B., Oliveira, B., Torres, H.R., Morais, P., Fonseca, J.C. and Vilaça, J.L. (2022, September). Augmented synthetic dataset with structured light to develop AI-based methods for breast depth estimation. In *6th ICBEB 2022 – International Conference on Biomedical Engineering and Bioinformatics* (September 18-20, 2022, Berlin, Germany). *(ISI/Scopus indexed International Conference Paper)*

23. Valente, S., Morais, P., Torres, H.R., Oliveira, B., Gomes-Fonseca, J., Buschle, LR, Fritz, A., Correia-Pinto, J., Lima E. and Vilaça, J.L. (2022). A deep learning method for kidney segmentation in 2D ultrasound images. In *44th Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC)*, 2022, pp. 3911-3914, DOI: https://doi.org/10.1109/EMBC48229.2022.9871748 *(ISI/Scopus indexed International Conference Paper)*

24. Oliveira, B., Torres, H. R., Morais, P., Baptista, A., Fonseca, J. and Vilaça, J. L. (2022). Classification of Chronic Venous Disorders using an Ensemble Optimization of Convolutional Neural Networks. *In 44th Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC)*, 2022, pp. 516-519. DOI: https://doi.org/10.1109/EMBC48229.2022.9871502 *(ISI/Scopus indexed International Conference Paper)*

25. Real, A., Morais, P., Barbosa, L.C.N., Gomes-Fonseca, J., Oliveira, B., Moreira, A.H.J. and Vilaça, J.L. (2022). A sensorized needle guide for ultrasound assisted breast biopsy. *In 44th Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC)*, 2022, pp. 865-868. DOI: https://doi.org/10.1109/EMBC48229.2022.9871148 *(ISI/Scopus indexed International Conference Paper)*

26. Ribeiro, R.F, Gomes-Fonseca, J., Torres, H.R, Oliveira, B., Vilhena, E., Morais, P., and Vilaça, J.L. (2022). Deep learning methods for lesion detection on mammography images: a comparative analysis. In *44th Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC)*, 2022, pp. 3526-3529. DOIi: https://doi.org/10.1109/EMBC48229.2022.9871452 *(ISI/Scopus indexed International Conference Paper)*

27. Fernández-Rodríguez, M., Rodrigues, N., Morais, P., Oliveira, B., Buschle, LR., Correia-Pinto, J., Lima, E. and Vilaça, J.L. (2022). Feasibility Study on Automatic Surgical Phase Identification based on Speech Recognition for Laparoscopic Prostatectomy. In *44th Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC)*, 2022, pp. 4411-4414. DOI: https://doi.org/10.1109/EMBC48229.2022.9870990 *(ISI/Scopus indexed International Conference Paper)*

28. Nuno Fernandes, João Borges, António H.J. Moreira. (2022). Artificial vision inspection system for anomaly detection in metal stamped parts, *Procedia Computer Science*, Vol. 204, pp. 558-565, ISSN 1877-0509. DOI: https://doi.org/10.1016/j.procs.2022.08.068 *(ISI/Scopus indexed International Conference Paper)*

29. Sandra Dixe, João Sousa, Jaime C. Fonseca, António H.J. Moreira, João Borges. (2022). Optimized in-vehicle multi person human body pose detection, *Procedia Computer Science*, Vol. 204, pp. 479-487, ISSN 1877-0509 DOI: https://doi.org/10.1016/j.procs.2022.08.059 *(ISI/Scopus indexed International Conference Paper)*

30. Leiras, V., Dixe, S., Da Costa, N.M.C., Moreira, A.H.J., Borges, J. (2022). ISO23247 Digital Twin Approach for Industrial Grade Radio Frequency Testing Station. In *IEEE International Conference on Emerging Technologies and Factory Automation, ETFA, 2022*. *(IN PRESS) (ISI/Scopus indexed International Conference Paper)*

31. Miranda, D., Barbosa, J. C., Gonçalves, R., Miranda, F., Vilaça, J.L., Costa, C. M. and Lanceros-Méndez, S. (2022). Theoretical Simulation of Solid Polymer Electrolyte Based on Poly(vinylidene fluoride) with Lithium Salts for Lithium-Ion Battery Application. In *7th Symposium on Modelling and Simulation in Computer Sciences and Engineering (MSCSE 2022) of the International Conference of Numerical Analysis and Applied Mathematics 2022, (ICNAAM 2022). (IN PRESS) (ISI/Scopus indexed International Conference Paper)*

32. Pereira, S.G, Morais, P., Veloso, F., Moreira, A.H.J., Miranda, D. Machado, J., Martins, J. and Vilaça, J.L. (2022). Insertion of RFID tags into plastic parts using ultrasonic welding. In In *IECON 2022–48th Annual Conference of the IEEE Industrial Electronics Society* (pp. 1-6). *(ISI/Scopus indexed International Conference Paper)*

33. Barbosa, L., Moreira, A., Carvalho, V., Vilaça, J.L. and Morais, P. (2022, September). Bisoginal Databases for Training of Artificial Intelligent Systems. In *6thICBEB 2022 – International Conference on Biomedical Engineering and Bioinformatics* (September 18-20, 2022, Berlin, Germany). *(ISI/Scopus indexed International Conference Paper)*

34. Pereira, S.G, Barros, T.H, Matos, D., Terroso, M., Machado, J., Martins, J., Morais, P. and Vilaça, J.L. (2022, October). RFID reader multidirecional system. In *IECON 2022 – 48th Annual Conference of IEEE Industrial Electronics Society* (October 17-20, 2022, Brussels). *(ISI/Scopus indexed International Conference Paper)*

35. Brito, J.H., da Silva, A.F., Pereira, J.M., Abreu, A. (2022). Bankruptcy Prediction with Machine Learning: The Case of Portuguese and Spanish Hospitality Sector. In *Advances in Tourism, Technology*

and Systems. Smart Innovation, Systems and Technologies, Vol. 284. Springer, Singapore. DOI: https://doi.org/10.1007/978-981-16-9701-2_14 *(ISI/Scopus indexed International Conference Paper)*

36. Lopes, N., Costa, B., Alves, C.F, Putnik, G.D, Varela, L., Maria M. Cruz-Cunha and Ferreira, L. (2022). The Impact of Technological Implementation Decisions on Job-Shop Scheduling Simulator Performance Using Secondary Storage and Parallel Processing. In *Managing and Implementing the Digital Transformation. ISIEA 2022*. Lecture Notes in Networks and Systems, vol 525. Springer, Cham. DOI: https://doi.org/10.1007/978-3-031-14317-5_19 *(ISI/Scopus indexed International Conference Paper)*
37. Castro, H., Costa, F., Ferreira, L., Ávila, P., Goran D. Putnik and Cruz-Cunha, M. (2022). Data Science for Industry 4.0: A Literature Review on Open Design Approach, Procedia Computer Science, Vol. 204, pp. 877-884. DOI: https://doi.org/10.1016/j.procs.2022.08.106 *(ISI/Scopus indexed International Conference Paper)*

38. Varela, L., Putnik, G.D., Alves, C.F., Lopes, N., Cruz-Cunha, M.M. (2022). A Systematic Review of Manufacturing Scheduling for the Industry 4.0. In *Managing and Implementing the Digital Transformation, ISIEA 2022.* Lecture Notes in Networks and Systems, vol 525. Springer, Cham. DOI: https://doi.org/10.1007/978-3-031-14317-5_20 *(ISI/Scopus indexed International Conference Paper)*

39. Lima, O., Terroso, M., Dias, N., Vilaça, J. L., Matos, D. (2022). Development of a Pill Dispenser: System Requirements and Product Architecture. In *Advances in Design and Digital Communication III. DIGICOM 2022*. Springer Series in Design and Innovation , Vol. 27. Springer, Cham. DOI: https://doi.org/10.1007/978-3-031-20364-0_29 *(ISI/Scopus indexed International Conference Paper)*

40. Cunha, V., Carvalho, V., Machado, J., Soares, F. (2022). Industrial Networks Protocols PROFIBUS and RS485 – A Description of the Most Common Problems. In *International Conference on Reliable Systems Engineering (ICoRSE) – 2022, ICoRSE 2022.* Lecture Notes in Networks and Systems, Vol. 534. Springer, Cham. DOI: https://doi.org/10.1007/978-3-031-15944-2_33 *(ISI/Scopus indexed International Conference Paper)*

41. Almeida, A., Mateus-Coelho, N., Lopes, N. and Portela, I. (2022). Paranoid OS: Wearable Trackers. *Procedia Computer Science*, Vol. 204, pp. 862-868. DOI: https://doi.org/10.1016/j.procs.2022.08.104 *(ISI/Scopus indexed International Conference Paper)*

42. Azevedo, R., P. Silva, J., Lopes, N., Curado, A., Nunes, L.J. R. and Lopes, S.I. (2022). Towards Indoor Radon Analytics: An OLAP-based Multidimensional Approach. In *DATA 2022 - 11th International Conference on Data Science, Technology and Applications*. ISBN: 978-989-758-583-8; ISSN: 2184-285X *(ISI/Scopus indexed International Conference Paper)*
43. Gonçalves, A.T., Alves, I.F., Carvalho, A.M. (2022). Analysis of ISO 9001:2015 certification in Portugal and comparison with other countries: effects of development scores, crisis, and economic cycles. In *International Conference on Quality Engineering and Management, 2022*, pp. 1051–1067 *(ISI/Scopus indexed International Conference Paper)*

44. Viana, Ó.T., Terroso, M., Serejo, C., Vilaça, J.L. (2023). Ascertaining the Influence of Style on the Credibility and Appeal of a Digital Health Avatar. In *Advances in Design and Digital Communication III. DIGICOM 2022*. Springer Series in Design and Innovation , vol 27. Springer, Cham. DOI: https://doi.org/10.1007/978-3-031-20364-0_6 *(ISI/Scopus indexed International Conference Paper)*

45. Lima, O., Terroso, M., Dias, N., Vilaça, J.L., Matos, D. (2022). Development of the Business Model and User Experience for a Pill Dispenser: A Designer Perspective. In *Design and Digital Communication II (DIGICOM 2021)*, Springer Series in Design and Innovation, Vol. 19. DOI: https://doi.org/10.1007/978-3-030-89735-2_45 *(ISI/Scopus indexed International Conference Paper)*

46. Rocha, A., Amorim, M., Romero, F., Miranda, D. and Lima, R. M. (2022). Quality management practices to direct and control the accomplishment of project objectives in R&D units. In *CENTERIS 2022 - International Conference on ENTERprise Information Systems Organising Committee*, Lisboa, Portugal. *(IN PRESS) (ISI/Scopus indexed International Conference Paper)*
47. Silvio Giancola, Anthony Cioppa, Adrien Deliège, Floriane Magera, Vladimir Somers, Le Kang, Xin Zhou, Olivier Barnich, Christophe De Vleeschouwer, Alexandre Alahi, Bernard Ghanem, Marc Van Droogenbroeck, Abdulrahman Darwish, Adrien Maglo, Albert Clapés, Andreas Luyts, Andrei Boiarov, Artur Xarles, Astrid Orcesi, Avijit Shah, Baoyu Fan, Bharath Comandur, Chen Chen, Chen Zhang, Chen Zhao, Chengzhi Lin, Cheuk-Yiu Chan, Chun Chuen Hui, Dengjie Li, Fan Yang, Fan Liang, Fang Da, Feng Yan, Fufu Yu, Guanshuo Wang, H. Anthony Chan, He Zhu, Hongwei Kan, Jiaming Chu, Jianming Hu, Jianyang Gu, Jin Chen, João V. B. Soares, Jonas Theiner, Jorge De Corte, José Henrique Brito, Jun Zhang, Junjie Li, Junwei Liang, Leqi Shen, Lin Ma, Lingchi Chen, Miguel Santos Marques, Mike Azatov, Nikita Kasatkin, Ning Wang, Qiong Jia, Quoc Cuong Pham, Ralph Ewerth, Ran Song, Rengang Li, Rikke Gade, Ruben Debien, Runze Zhang, Sangrok Lee, Sergio Escalera, Shan Jiang, Shigeyuki Odashima, Shimin Chen, Shoichi Masui, Shouhong Ding, Sin-wai Chan, Siyu Chen, Tallal El-Shabrawy, Tao He, Thomas B. Moeslund, Wan-Chi Siu, Wei Zhang, Wei Li, Xiangwei Wang, Xiao Tan, Xiaochuan Li, Xiaolin Wei, Xiaoqing Ye, Xing Liu, Xinying Wang, Yandong Guo, Yaqian Zhao, Yi Yu, Yingying Li, Yue He, Yujie Zhong, Zhenhua Guo, and Zhiheng Li. (2022). SoccerNet 2022 Challenges Results. In *Proceedings of the 5th International ACM Workshop on Multimedia Content Analysis in Sports (MMSports '22). Association for Computing Machinery*, New York, NY, USA, 75–86. DOI: https://doi.org/10.1145/3552437.3558545 *(ISI/Scopus indexed International Conference Paper)*

48. Silva, L., Rocha, D., Carvalho, V., Esteves, J. and Soares, F. (2022). Automatic Wardrobe for Blind People. In *EAI HealthyIoT 2022 – 9th EAI International Conference on IoT Technologies for People, EAI HealthyIoT 2022 – 9th EAI International Conference on IoT Technologies for HealthCare*, 16-18 November 2022, Braga, Portugal. *(ISI/Scopus indexed International Conference Paper)*

49. Barbosa, L., Real, A., Moreira, A., Carvalho, V., Vilaça, J. and Morais, P. (2022). ECG Classification with Deep Learning Models – A Comparative Study. In *EHB 2022 – 10th IEEE International Conference of e-Health and Bioengineering*, 17-18 November 2022, Iasi, Romania. *(ISI/Scopus indexed International Conference Paper)*

50. Mendes, A., Duque, D. and Carvalho, V. (2022). A Review on the Use of Virtual Reality on Therapy and Diagnosis of Schizophrenia. In *SEIA 2022 – 8th International Conference on Sensors and Electronic Instrumentation*, 21-23 September 2022, Corfu, Greece. *(ISI/Scopus indexed International Conference Paper)*

51. Faria, N., Carvalho, V. and Campelos, S. (2022). Development of a Lung Cancer Diagnosis Support System. In *ALLSENSORS 2022 – The Seventh International Conference on Advances in Sensors, Actuators, Metering and Sensing*, 26-30 June 2022, Porto, Portugal. *(ISI/Scopus indexed International Conference Paper)*

52. Faria, N., Carvalho, V. and Campelos, S. (2022). Cancer Detec - Lung Cancer Diagnosis Support System: First Insight. In *BIOINFORMATICS 2022 – 13th International Conference on Bioinformatics, Models, Methods and Algorithms*, 9-11 February 2022 (online streaming). *(ISI/Scopus indexed International Conference Paper)*

53. Antunes, A., Braga, A. and Gonçalves, J. (2022). Drowsiness Detection using Multivariate Statistical Process Control. In *International Conference on Computational Science and Its Applications*, Malaga. *(ISI/Scopus indexed International Conference Paper)*

54. Antunes, A., Menezes, M., Braga, A. and Gonçalves, J. (2022). Drowsy Classifier using Multivariate Statistical Process Control based on Principal Component Analysis. In *16th World Sleep Congress*, Rome. *(ISI/Scopus indexed International Conference Paper)*

55. Silva, J.P. and Gonçalves, J. (2022). Process standardization: the driving factor for bringing artificial intelligence and management analytics to SMEs. In *WAPAIS 2022 –1st Workshop on Applications of Artificial Intelligence for Society,* em Istanbul, Turquia. *(ISI/Scopus indexed International Conference Paper)*

56. Pereira, G. and Gonçalves, J. (2022). Human Activity Recognition: A review. In *WAPAIS 2022 –1st Workshop on Applications of Artificial Intelligence for Society*, em Istanbul, Turquia. *(ISI/Scopus indexed International Conference Paper)*

57. Lobo, P., Vilaça, J., Torres, H., Oliveira, B. and Simões, A. (2022). Smart scan of blood test documents to be integrated in a mHealth application. In *E-Health and Bioengineering Conference (EHB*). IEEE, November. *(ISI/Scopus indexed International Conference Paper)*

58. Amorim, D., Miranda, F., Ferreira, L., and Abreu, C. (2022). Data-Driven Carbohydrate Counting Accuracy Monitoring: A Personalized Approach. *Procedia Computer Science*, 204, 900–906. DOI: https://doi.org/10.1016/J.PROCS.2022.08.109. *(ISI/Scopus indexed International Conference Paper)*

59. Ferreira, L. (2022). Keynote Speech: ICT as the Key Enabling Technology in the age that THINGS look learning. In *iSCSi-2022 – International Conference in Industry Sciences and Computer Sciences,* 09-11 March, 2022, ISLA. Porto, Portugal. *(ISI/Scopus indexed International Conference Paper)*

3.4 BOOK CHAPTERS

1. Viana, Ó.T., Terroso, M., Serejo, C. and Vilaça, J.L. (2022). "A Comparison Review of Existing Personal Health Management Apps" from Chapter in book Springer Series in Design and Innovation, 2023, 25, pp. 83–92. DOI: https://doi.org/10.1007/978-3-031-09659-4_7

2. Queirós, R., Pinto, M., Simões, A. and Portela, C. F. (2022). "A primer on gamification standardization" from Chapter in book Advances in human and social aspects of technology, pp. 1–13. IGI Global. https://doi.org/10.4018/978-1-7998-8089-9.ch001

3. Ferreira, L., Putnik, G.D., Varela, M.L.R., Manupati, V.K., Lopes, N., Cunha, M., Alves, C. and Castro, H. (2022). "A Framework for Collaborative Practices Platforms for Humans and Machines in Industry 4.0–Oriented Smart and Sustainable Manufacturing Environments" from Chapter in book Smart and Sustainable Manufacturing Systems for Industry 4.0. ISBN: 9781003123866

3.5 ABSTRACTS IN NATIONAL CONFERENCES

1. Barbosa, L., Real, A., Moreira, A., Carvalho, V., Vilaça, J. and Morais, P. (2022). ECG Classificaiton with Deep Learning Models – A Comparative Study. In *SASYR 2022 – 2nd Symposium of Applied Science for Young Researchers*, 22 June 2022, Viana do Castelo, Portugal.

2. Ferreira, M., Torres, H. R., Oliveira, B., Morais P., Novais, P., Vilaça, J. L. (2022). Deep Learning Networks for Lesion Segmentation in Breast Ultrasound: A comparative analysis. In *SASYR 2022 – 2nd Symposium of Applied Science for Young Researchers*, 22 June 2022, Viana do Castelo, Portugal.

3. Rodrigues N. S., Fernández-Rodríguez M., Vilaça, J. L. (2022). Feasibility Study on Automatic Surgical Phase Identification based on Speech for Laparoscopic Prostatectomy. In *SASYR 2022 – 2nd Symposium of Applied Science for Young Researchers*, 22 June 2022, Viana do Castelo, Portugal.
4. Rodrigues, R., Fonseca, J. C., Moreira, A. H. J. (2022). Intelligent Digital Twins for Hyper Automation Manufacturing. In *SASYR 2022 – 2nd Symposium of Applied Science for Young Researchers*, 22 June 2022, Viana do Castelo, Portugal.

5. Correia, H., Brito, J. H. (2022). Intelligent Digital Twins for Hyper Automation Manufacturing. In *SASYR 2022 – 2nd Symposium of Applied Science for Young Researchers*, 22 June 2022, Viana do Castelo, Portugal.

6. Barros, T. H., Vilaça, J. L., Morais, P. (2022). Reading RFID Tags usinga Motorized System. In *SASYR 2022 – 2nd Symposium of Applied Science for Young Researchers*, 22 June 2022, Viana do Castelo, Portugal.

7. Oliveira, B., Torres, H. R., Morais, P., Baptista, A., Fonseca, J. C., Vilaça J. L. (2022). Optimization of an Ensemble CNN for the classification of Chronic Venous Disorders. In *SASYR 2022 – 2nd Symposium of Applied Science for Young* Researchers, 22 June 2022, Viana do Castelo, Portugal.

8. Ribeiro, R. F., Torres, H. R., Oliveira, B., Vilhena, E., Morais, P., Vilaça, J. L. (2022). Deep Learning Methods for Lesion Detection on Mammography Images: a Comparative Analysis. *In SASYR 2022 – 2nd Symposium of Applied Science for Young Researchers, 22 June 2022, Viana do Castelo, Portugal.*

9. Faria, J. M., Moreira, A. H. J. (2022). Autonomous Mobile Robot for Convetion Wheelcharis transportation in Healthcare Institutions. *In SASYR 2022 – 2nd Symposium of Applied Science for Young Researchers, 22 June 2022, Viana do Castelo, Portugal.*

10. Escrivães, I. I., Torres, H., Oliveira, B., Vilaça, J. L., Morais, P. (2022). ECG classification using Artificial Intelligence: Model optimization and robustness assessment. *In SASYR 2022 – 2nd Symposium of Applied Science for Young Researchers, 22 June 2022, Viana do Castelo, Portugal.*

11. Valente, S., Morais, P., Torres, H. R., Oliveira, B., Gomes-Fonseca, J., Buschle, L. R., Fritz, A., Correia-Pinto, J., Lima, E., Vilaça, J. L. (2022). Kidney Segmentation in 2D Ultrasound Images using Deep Learning. *In SASYR 2022 – 2nd Symposium of Applied Science for Young Researchers, 22 June 2022, Viana do Castelo, Portugal.*

12. Real, A., Morais, P., Barbosa, L. C. N., Gomes-Fonseca, J., Oliveira, B., Moreira, A. H. J., Vilaça, J. L. (2022). A sensorized needle guide for ultrasound assisted biopsy. *In SASYR 2022 – 2nd Symposium of Applied Science for Young Researchers, 22 June 2022, Viana do Castelo, Portugal.*

13. Caldas, A., Strozs, R., Gomes-Fonseca, J., Carvalho, V., Matos, D., Terroso, M., Morais, P., Vilaça, J. L. (2022). Tissue Mimicking Materials for Breast Phantoms: Synthetic Materials for Ultrasound Imaging.

In SASYR 2022 – 2nd Symposium of Applied Science for Young Researchers, 22 June 2022, Viana do Castelo, Portugal.

14. Oliveira, V. M., Pereira, D., Oliveira, B., Morais, P., Duque, D., Vilaça J. L., Moreira, A. H. J. (2022). Validation of of a Robotic and Game-based framework for upper limb rehabilitation. *In SASYR 2022 – 2nd Symposium of Applied Science for Young Researchers, 22 June 2022, Viana do Castelo, Portugal.*

15. Costa, J. N., Valente, S., Ferreira, L., Oliveira, B., Torres, H. R., Morais, P., Alves, V., Vilaça, J. L. (2022). Ultrasound Training Simulator Using Augmented Reality Glasses: an Accuracy and Precision Assessment Study. *In SASYR 2022 – 2nd Symposium of Applied Science for Young Researchers, 22 June 2022, Viana do Castelo, Portugal.*
16. Martins, P. M., Vilaça, J. L., Dias, N. S. (2022). A mobile digital assistant for treatment monitoring. *In SASYR 2022 – 2nd Symposium of Applied Science for Young Researchers, 22 June 2022, Viana do Castelo, Portugal.*

17. Pinto, J., Vilaça, J. L., Dias, N. S. (2022). Artificial Intelligence system to detect and deblister medication for smart pill dispensar. *In SASYR 2022 – 2nd Symposium of Applied Science for Young Researchers, 22 June 2022, Viana do Castelo, Portugal.*

18. Lobo, P., Vilaça, J. L., Simões, A. (2022). Smart scan of medical device display to integrate an mHealth. *In SASYR 2022 – 2nd Symposium of Applied Science for Young Researchers, 22 June 2022, Viana do Castelo, Portugal.*

19. Pereira, S. G., Morais, P., Vilaça, J. L. (2022). Insertion of RFID tags into plastic parts using ultrasonic welding. *In SASYR 2022 – 2nd Symposium of Applied Science for Young Researchers, 22 June 2022, Viana do Castelo, Portugal.*

20. Pereira, J., Torres, H. R., Veloso, F., Oliveira, B., Morais, P., Vilaça, J. L. (2022). Intelligent System for Real time monitoring of the Head Pose of Newborns. *In SASYR 2022 – 2nd Symposium of Applied Science for Young Researchers, 22 June 2022, Viana do Castelo, Portugal.*

3.6 PATENTS

1. Ferraz, A. and Carvalho, V., United States Patent Application 11288794B2 – Device and method for blood analysis by image processing; Date: 29-03-2022. URL: https://patents.google.com/patent/US11288794B2/en

2. Leão, P., Ribeiro, AC., Vilaça, J.L. and Sousa, N., United States Patent Application 20220226063 – Laser Pointer Device for Use in a Laproscopic Surgery Procedure; Date: 21-07-2022. URL: https://www.freepatentsonline.com/y2022/0226063.html

3. Vilaça, JL., Oliveira, B., Morais, P., Veloso, F., Moreira, A.H., Baptista, A., Fonseca, J. United States Patent Application 20220339465A1 – Device For Laser Skin Treatment; Date: 27-10-2022. URL: https://patents.google.com/patent/US20220339465A1/en

4. Oliveira, B., Morais, P., Vilaça, J. L.. Device and Operating Method for Laser Tattoo Removal. Provisional Patent – PP 20221000000924. Date: 22-02-2022. Status: provisional request.

5. Vilaça, J. L., Morais, P., Oliveira, B., Torres, H., Veloso, F., Real, A., Strozs, R., Araújo, A., Matos, D., Terroso, M.. Device for Assisting in Collecting a Biological Sample from a subject using a collection needle. Date: 20/12/2022. Provisional Patent - PP 20222004337092. Status: Provisional request.

3.7 ORGANIZATION OF COURSES/WORKSHOPS

5th Edition of the Winter School on Artificial Intelligence for Games: The Winter School on Artificial Intelligence applied to Games began in 2016, and has been held, annually, featuring professionals and researchers in the field of artificial intelligence, as well as in its application to digital games. This edition was organized in the School of Technology of IPCA at 8th April 2022.
2Ai members: Duque, D; Simões, A.

Intellectual property rights workshop: This online workshop was held in September 2022. The target audience were researchers and the academic community to learn about patent search and patent protection. Patentree, a firm specialized in filling, prosecution, and enforcement of intellectual property rights, was invited to talk about these themes. The workshop was organized under the Knowledge Circle project co-promoted by Polytechnical Institute of Leiria and the Polytechnical Institute of Cávado and Ave.
2Ai members: Vilaça J. L.

Licensing and Industrial Property: This online workshop was held in September 2022. The target audience were researchers and the academic community to talk about how to convey results stemming from scientific and technological research to the marketplace and to wider society, along with associated skills and procedures that can create utility for the ones who benefit from the use of project outcomes. The workshop was organized under the Knowledge Circle project co-promoted by Polytechnical Institute of Leiria and the Polytechnical Institute of Cávado and Ave.

2Ai members: Vilaça J. L.

Creation of the "Knowledge circle network": This network has been created in March 2022. The aim is to transfer knowledge and technology to organizations that can benefit from its application. This network is comprised by innovation and industry support organizations within the geographical area of influence of IPCA and the Polytechnical Institute of Leiria (IPL). Some of the specific objectives include, providing support to assess the technical solutions market potential, facilitate bilateral contacts with companies, support in gaining resources for new development stages, support the creation of new start-up and spin-off companies, and in transferring knowledge and technical research outcomes. The partnering organizations from the area of influence of IPCA are: InvestBraga, Famalicão Made In, AEMinho, CEVAL, CETEVE, CIM Cávado, VilaWork, Parque Industrial Barbosa de Oliveira, AveParque, Set.up Guimarães. The partnering organizations from the area of influence of

IPL are: CEFAMOL, AIRO, APIP, CIMRL, Nerlei, Obitec, OPEN, SFCOLAB, APSPPCTMP, Startup Leiria, Startup Lourinhã. More information in: https://knowledgecircle.pt/.
2Ai members: Vilaça J. L.

Additionally, 2Ai members also participated in the implementation of short advanced programs (further detailed in section 5) and in the implementation of dedicated research training workshops under the RUN-EU project (further detail in section 11).

3.8 ORGANIZATION OF CONFERENCES

Symposium on Mathematical Methods for Artificial Intelligence and Its Applications (MMAIA 2022) of 20th International Conference of Numerical Analysis and Applied Mathematics 2022 (ICNAAM 2022) took place in Heraklion, Crete, Greece, from 19th to 25th September, 2022. Artificial Intelligence (AI) is an area of computer science that makes it possible for machines to learn from experience, adjust to new inputs, and react like humans. Several mathematical methods, and numerical algorithms, have been devised and developed to support the growth of AI to better teach machines to behave like a human. The activities of the symposium will include the discussion of actual mathematical methods and numerical algorithms for AI, where will be presented theoretical studies and experimental results. URL: https://sites.google.com/view/mmaia2022/
2Ai members: Miranda, D.

10th International Conference on Serious Games and Applications for Health, IEEE SeGAH 2022 - took place in Sydney, Australia, from 10 – 12 of August 2022, at the University of Wollongong. The overall objectives of the conference are the discussion and sharing of knowledge, experiences and scientific and technical results, related to state-of-the-art solutions and technologies on serious games and applications for health and healthcare, as well as the demonstration of advanced products and technologies. URL: http://www.segah.org/2022/
2Ai members: Duque, D.; Dias, D.; Vilaça J.L., Morais, P.

7th Symposium on Modelling and Simulation in Computer Sciences and Engineering (MSCSE 2022) of 20th International Conference of Numerical Analysis and Applied Mathematics 2022 (ICNAAM 2022) took place in Heraklion, Crete, Greece, from 19th to 25th September, 2022. Modelling and simulation, applied to computer sciences and engineering, is an exciting investigation field that brings together the power of computers and the physical sciences. Computer-based simulations and graphical visualization now play a key role in mathematical models, scientific investigations and engineering design. URL: https://sites.google.com/view/2022mscse/home
2Ai members: Miranda, D.

3rd International Computer Programming Education Conference (ICPEC) - 2-3 June, 2022 -ICPEC aims to be a space frequented by teachers and researchers to discuss topics that promote new methodologies, best practices, trends, techniques and tools to improve the

teaching-learning process of computer programming. The ICPEC was help in School of Technology, IPCA, Barcelos, Portugal. URL: https://icpeconf.org/2022
2Ai members: Simões, A.; Miranda, D.

Symposium on Languages, Applications and Technologies (SLATE 2022) - 14-15 July, 2022 -SLATE is an international symposium dedicated to researchers and professionals interested in the study of languages. Since this is a very broad subject, the symposium is divided into three main tracks, each one focusing on a specific aspect of languages (Human-Human Languages, Human-Computer Languages and Computer-ComputerLanguages). The SLATE 2022 Conference was held in UBI, Covilhã, Portugal. URL: http://slate-conf.org/2022
2Ai members: Simões, A.

WAPAIS 2022 – 1st Workshop on Applications of Artificial Intelligence for Society - co-located with the IEEE 10th International Symposium on Digital Forensics and Security, Turkey, June 2022. This workshop will promote a space for debate about the present and the future of artificial intelligence as a tool to improve the various services, public and private, that support the community, resulting in a substantial increase in the population's quality of life.
2AI members:Lopes N., Gonçalves J.

CENTERIS – International Conference on ENTERprise Information Systems - The conference took place in Lisbon, Portugal, from 9 to 11 of November 2022. During this 3-day conference, under the leitmotiv of Enterprise Information Systems, academics, scientists, IT/IS professionals, managers and solution providers from all over the world have the opportunity to share experiences, bring new ideas, debate issues, and introduce the latest developments in the largely multidisciplinary field embraced by the Enterprise Information. URL: http://centeris.scika.org/
2Ai members: Cruz-Cunha, M.

6th Symposium on Applied Research - The SAR (Symposium on Applied Research) is a Workshop organized in the School of Technology at IPCA, where Master Degree's Students and Young Researchers are invited to present their work. All works are peer-reviewed and a final presentation in poster or oral format is performed in an Open-Day format. URL: http://web.ipca.pt/symposium/2022/index.html.
2Ai members: Carvalho V., Dias N., Miranda D., Morais P., Simões A., Vilaça J., Vilhena E.

2nd Symposium of Applied Science for Young Researchers - SASYR, the first Symposium of Applied Science for Young Researchers, welcomes works from young researchers (master students) covering any aspect of all the scientific areas of the three research centres ADiT-lab (IPVC, Instituto Politécnico de Viana do Castelo), 2Ai (IPCA, Instituto Politécnico do Cávado e do Ave) and CeDRI (IPB, Instituto Politécnico de Bragança). The main objective of SASYR is to provide a friendly and relaxed environment for young researchers to present

their work, to discuss recent results and to develop new ideas. URL: http://sasyr.ipb.pt/EN_index.html.
2Ai members: Morais, P.; Vilaça, J.

EAI Edge-IoT 2022 - 2nd EAI International Conference on Intelligent Edge Processing in the IoT Era - 16-18 November, 2022, the EAI Edge-IoT 2022 conference has been created as a flagship conference aiming at addressing the decentralization of contemporary processing paradigms, notably Edge processing, focusing on the increasing demand for intelligent processing at the edge of the network, which is paving the way to the Intelligent IoT Era. URL: https://edge-iot.eai-conferences.org/2022/

2Ai members: Moreira, A.

Special Session "Wearable Healthcare" of BIODEVICES 2022 – 15th International Conference on Biomedical Electronics and Devices - 9-11 February, 2022 (Online streaming), the purpose of the International Conference on Biomedical Electronics and Devices is to bring together researchers and practitioners from electronics, mechanical engineering, physics and related areas who are interested in developing, studying and using innovative materials, devices and systems inspired by biological systems and/or addressing biomedical requirements. Monitoring and diagnostics devices, sensors and instrumentation systems, biorobotics and prosthetics, micro-nanotechnologies including microfluidics systems and biomaterials are some of the technologies addressed at this conference (Online Streaming). URL: https://biodevices.scitevents.org/?y=2022
2Ai members: Carvalho, V.

Organizing Committee of ICIE 2022 – 2nd International Conference on Innovation and Engineering - 28/30 June, 2022, the ICIE 2022 conference brings together academicians, professionals, business practitioners from various Engineering fields, as well as, related fields from all over the world to share their ideas, authentic research results and practical experiences. This conference will also become a platform for both academicians and professionals from multi-disciplinary interests to meet and interact with members inside and outside their own particular disciplines. URL: https://icieng.eu/
2Ai members: Carvalho, V.

International Conference on Industry Sciences & Computer Sciences Innovation Special track on Industry Applications (iSCSi'22)- took place on March 9-11, 2022 at Polytechnic Institute of Management and Technology, Gaia, Porto, Portugal. ISCSI will bring together participants from academia and industry in a forum for exchanging news and research results on theory and applications of industry sciences and computer sciences innovations and applications on industry. URL: https://iscsi-conference.org/2022/01/18/special-track-workshop-on-industry-applications/
2Ai members: Ferreira, L., Carvalho, V.

3.9 OTHERS

Public Datasets (https://2ai.ipca.pt/public-datasets/)

SatSuperRes dataset: dataset with high quality/ low quality image pairs of satellite imagery. *Public available under request.*
(2Ai members: Brito, J.)

SatFire3 dataset: dataset with burned areas and images before and after each fire. *Public available under request.*
(2Ai members: Brito, J.)

SatForest2 dataset: dataset with Sentinel2 satellite imagery and land use/land cover classification (COS2018). *Public available under request.*
(2Ai members: Brito, J.)

Mathematical Models

AI to segment and classify lesions in breast US images.
(2Ai members: Morais, P., Vilaça, J.)

AI to segment and classify lesions in breast X-ray images.
(2Ai members: Morais, P., Vilaça, J.)

AI Model for tinyML motor anomaly.
(2Ai members: Moreira, A.)

AI Model in embedded electronic nose for Predictive Maintenance.
(2Ai members: Moreira, A.)

Computational Applications

LeXmart: A tool to support the lexicographic work on language dictionaries. Link: https://lexmart.eu
(2Ai members: Simões, A)

Webservice functional prototype: Webservice functional prototype for head 3D reconstruction.
(2Ai members: Brito, J.)

Smartphone app: Smartphone app prototype for head 3D reconstruction UI.
(2Ai members: Brito, J.)

Soccer Pitch Markings Segmenter:
- Third place in n SoccerNet 2022 Pitch Localization Challenge.
- Fourth place in SoccerNet 2022 Camera Calibration Challenge.
(2Ai members: Brito, J.)

RehabVerse: Virtual Reality Video Game for Upper Limb Rehabilitation. Link: github.com/GemsJames/RehabVerse
(2Ai members: Duque, D.)

SmartHealth Rehab application: A Robotic and Game-Based Framework for Assisted Upper Limb Rehabilitation.
(2Ai members: Moreira, A., Vilaça J.L.)

OncoNavigator: A new interface to guide breast biopsies.
(2Ai members: Morais, P., Vilaça, J.L.)

Laboratorial prototypes

Virtual Reality video game, composed of Oculus Quest 2 and Kuka robot, for upper limb rehabilitation.
(2Ai members: Duque, D., Moreira, A., Vilaça, J.)

Device: AI-Based Electronic Nose for Predictive Maintenance.
(2Ai members: Moreira, A.)

Device: TINYML SYSTEM FOR PREDICTIVE MOTOR ANOMALY.
(2Ai members: Moreira, A.)

Device: Wireless in-ear monitoring device for COVID19
(2Ai members: Moreira, A., Morais, P., Vilaça J., Carvalho, V.,)

Setup & Software: Robotic and game-based framework for assisted upper limb rehabilitation.
(2Ai members: Duque, D., Moreira, A., Vilaça, J.)

Ph.D.'s Theses in progress

Eduardo Pimentel, Printable piezoresistive materials based on natural polymers for medical device applications, Ph.D. in Materials Engineering, University of Minho & 2Ai IPCA (supervisor: Miranda, D.)

Ricardo Rodrigues, Intelligent Digital Twin for Hyper Automation Manufacturing, Ph.D. in Industrial Electronics and Computer Engineering, University of Minho & 2Ai IPCA (supervisor: Moreira, A.)

Fernando José da Silva Veloso, Development of a customized cranial orthosis for the correction of positional plagiocephaly, Ph.D. in Mechanical Engineering, University of Minho & ICVS (Supervisor: Vilaça, J.L.)

Bruno Miguel Gomes Oliveira, Artificial Intelligence collaboration robot for patient-specific laser treatment of vascular lesions, Ph.D. in Biomedical Engineering, University of Minho & ICVS & Algoritmi & 2Ai IPCA (Supervisor: Vilaça, J.L.)

Helena Daniela Ribeiro Torres, Cranial Orthosis Modeling and Treatment Outcome Prediction Framework for Infants with Deformational Plagiocephaly, Ph.D. in Biomedical Engineering, University of Minho & 2Ai IPCA (Supervisor: Vilaça, J.L.)

Simão Valente, A new smart and intuitive interface for Percutaneous Nephrolithonomy guidance, Ph.D. in Health Sciences, University of Minho & 2Ai IPCA (Supervisor: Vilaça, J.L.)

Nuno Rodrigues, Enhanced Surgical Rooms for Robotic-Guidance Urologic Interventions, Ph.D. in Health Sciences, University of Minho & 2Ai IPCA (Supervisor: Vilaça, J.L.)

Isaías Barbosa, "Sistema de alerta inteligente para doentes ostomizados", Ph.D. in Industrial Electronics and Computers, University of Minho & 2Ai IPCA (Supervisor: Vilaça, J.L.)
Inês Escrivães, Creation of a surveillance circuit of vital signs to promote the public health condition of the surrounding population. Programa de Doutoramento en Epidemioloxia e Saúde Publica. (Supervisor: Morais P.)

Pedro Cunha, SPERTA – Real-Time Evaluation for Top Taekwondo Athletes, Ph.D. in Industrial Electronics and Computers, University of Minho. (Supervisor: Carvalho, V.)

Daniel Rocha, Desenvolvimento de um Sistema Inteligente de Identificação e Combinação de Vestuário para Cegos, PhD. in Industrial Electronics and Computers, University of Minho. (Supervisor: Carvalho, V.)

Filipe Pereira, Desenvolvimento de Algoritmos de Visão Computacional para Identificação e Análise da Qualidade do Fio Têxtil em Ambiente Industrial, Ph.D. in Industrial Electronics and Computers, University of Minho. (supervisor: Carvalho, V.)

Ahmed Fadlelmoula, Fabrication of a New In-Vitro Diagnostic (IVD) Device Using Label Free Fourier Transform IR (FTIR) Spectroscopy to Analyse Human Blood, Ph.D. in Biomedical Engineering, University of Minho. (supervisor: Carvalho, V.)

Marcos Fernández Rodríguez, New AI-assisted interfaces for improved surgical rooms, Ph.D. in Health Sciences, University of Minho & 2Ai IPCA (supervisor: Vilaça, J. L.).

Bruno Silva, Deep Learning Networks for Semantic Segmentation of Anatomical Structures in Laparoscopic Surgery, Ph.D. in Health Sciences, University of Minho & 2Ai IPCA (supervisor: Vilaça, J. L.).

Ana Antunes, Drowsy Driving Monitorization Using Statistical and Machine Learning Techniques, PhD in Engenharia Industrial de Sistemas, Universidade do Minho & 2Ai IPCA (supervisor: Gonçalves, J.)

Kelly O'Brien, Artificial Intelligence Based Approach to Live Speech Mapping, PhD in Mechanical & Automobile Engineering, TUS (Supervisor: Gonçalves, J.)

Miguel Ângelo Silva Pereira, Avaliação e Análise de Paradigmas e Modelos de Gestão Global de Recursos orientados à Indústria 4.0, Ph.D. in Production and Systems Engineering, University of Minho (supervisor: Cunha, M.M.)

Joana Vanessa Santos dos Reis, fMRI guided EEG - Neurofeedback as a therapeutic tool for treatment-resistant depression (TRD), Ph.D. in Health Sciences, University of Minho (supervisors: Dias, N.))

Completed Master's Theses

Catarina Andrade, Caraterização dos Conhecimentos sobre Segurança e Saúde no Trabalho nos Cursos Técnicos Superiores Profissionais do IPCA, Master in Integrated Management Systems: Quality, Environment and Safety, School of Technology, IPCA (supervisor: Vilhena, E.)

Maria Cláudia Silva, Saúde e Segurança no Teletrabalho – Riscos e Benefícios, Master in Integrated Management Systems: Quality, Environment and Safety, School of Technology, IPCA (supervisor: Vilhena, E.)

Filipa Alexandra Pereira Martins, Estudo de Caso da Implementação da ISO 9001:2015 por forma a certificar uma Empresa do Setor Têxtil, Master in Integrated Management Systems: Quality, Environment and Safety, School of Technology, IPCA (supervisor: Vilhena, E.)

Rosa Alexandra Rodrigues Abreu, Estudo dos Impactos Psicossociais do Uso da Máscara no IPCA, Master in Integrated Management Systems: Quality, Environment and Safety, School of Technology, IPCA (supervisor: Vilhena, E.)

Tânia Daniela Loureiro Rodrigues, Riscos Psicossociais numa Unidade de Saúde Mental, Master in Integrated Management Systems: Quality, Environment and Safety, School of Technology, IPCA (supervisor: Vilhena, E.)

Teresa Sofia Batista de Carvalho Araújo, Sistemas de Automação Robotizados para a Indústria apoiados em Soluções de Gestão de Sistemas Integrados de Qualidade e Ambiente, Master in Integrated Management Systems: Quality, Environment and Safety, School of Technology, IPCA (supervisor: Vilhena, E.)

Vera Constança Figueiredo Campinho, Impacto Psicossocial da Pandemia Covid-19 nos Técnicos de Análises Clínicas e de Saúde Pública em Portugal, Master in Integrated Management Systems: Quality, Environment and Safety, School of Technology, IPCA (supervisor: Vilhena, E.)

Sérgio Pereira, Easily Adaptable System for Inserting RFID Tags During Plastic Injection, Master in Electronic and Computer Engineering, School of Technology, IPCA (supervisors: Morais, P. and Vilaça, J. L.)

Luís Barbosa, Development of an AI System for Smart Safe Health Monitoring, Master in Electronic and Computer Engineering, School of Technology, IPCA (supervisor: Vilaça, J. L. and Morais, P.)

Inês Escrivães, Development of an artificial intelligence system for clinical analysis and prediction of risk episodes, Integrated Master in Biomedical Engineering, UMinho & 2Ai IPCA (supervisor: Morais, P.)

João Gonçalo Pereira, Sistema Inteligente para Monitorização em tempo real da rotação da cabeça em recém-nascidos.
Master in Electronic and Computer Engineering, School of Technology, IPCA (supervisors: Morais, P. and Vilaça, J. L.)

Pedro Lobo, Intelligent Medical Document Scanning System, Master in Electronic and Computer Engineering, School of Technology, IPCA (supervisor: Simões, A., Vilaça, J. L.)

Vitor Oliveira, A robotic and game-base framework for assisted upper limb rehabilitation, Master in Electronics and Computer Engineering, School of Technology, IPCA (supervisor: Moreira, A., Vilaça J.L.)

Claudino Costa, Wireless in-ear monitoring device for COVID-19, Master in Electronics and Computer Engineering, School of Technology, IPCA (supervisor: Moreira, A., Carvalho, V.)

André Giesteira, AI-Based Electronic Nose for Predictive Maintenance, Master in Electronics and Computer Engineering, School of Technology, IPCA (supervisor: Moreira, A.)
João Ferreira, TINYML System for predictive motor anomaly, Master in Electronics and Computer Engineering, School of Technology, IPCA (supervisor: Moreira, A.)

Bruno Matos, Jogos Cinemáticos: quão influentes técnicas cinemáticas conseguem ser na experiência imersiva do game play em videojogos, Master in Engineering of Digital Games Development, School of Technology, IPCA (supervisors: Duque, D., Teixeira, P.)

Eduardo Santos, Desenvolvimento de Conteúdos para Videojogos: A Importância da ligação entre jogador e personagem no media interativo, Master in Illustration and Animation, School of Design, IPCA (supervisor: , Duque, D.)

José Vilaça, Integração de sistemas diagnóstico em jogos digitais estudo de caso: Diagnóstico LEA, Master in Engineering of Digital Games Development, School of Technology, IPCA (supervisor: Duque, D.)

Sílvia Faria, Interface em Realidade Virtual para Sistema de Treino de Pilotos de Caça F16, Master in Digital Design, School of Design, IPCA. (supervisor: Carvalho, V.)

Nuno Costa, Modular Framework for a Breast Biopsy Smart Navigation System, Master in Informatic Engineering, School of Technology, IPCA (supervisor: Vilaça, J. L.)

Nuno Filipe Matos Peixoto, Emotion Prediction through audiovisual content analysis, Master in Informatics Engineering, School of Technology, IPCA. (supervisor: Dias, N.)

Pedro Martins, Inteligência Artificial para Monitorização de sintomas e do bem-estar durante tratamentos médicos Smart Health Digital Assistant, Master in Electronics and Computer Engineering, School of Technology, IPCA (supervisor: Dias N., A., Vilaça J.L.)

Master Theses in progress

Abílio Malheiro, O impacto do brand attachment no segmento luxury do setor automóvel: uma abordagem à marca Porsche, Master in Maketing. School of Hospitality and Tourism, IPCA (supervisor: Vilhena, E.)

Ângela Daniela Oliveira Fontes, Participação Variável em IRS: Perceção da Comunidade IPCA, Master in Organizational Management, School of Management, IPCA (supervisor: Vilhena, E.)

Ana Cristina Azevedo Maia, Sistemas Integrados de Gestão: Motivações e Benefícios dos SIG e Certificação nas Camaras Municipais, Master in Integrated Management Systems: Quality, Environment and Safety, School of Technology, IPCA (supervisor: Vilhena, E.)

Anabela Maciel Gonçalves, Fatores Explicativos do Equilíbrio Financeiro das Empresas: Evidencia Empírica para as empresas não financeiras do PSI 20, Master in Organizational Management, School of Management, IPCA (supervisor: Vilhena, E.)

Cátia deFátima Pinheiro Machado, Riscos Profissionais dos Técnicos de Segurança no Trabalho, Master in Integrated Management Systems: Quality, Environment and Safety, School of Technology, IPCA (supervisor: Vilhena, E.)

Cláudia Sofia Cerqueira Capela, Resistências a Antibióticos – Perceção dos Enfermeiros Veterinários sobre a sua Exposição ao Perigo e à sua Disseminação, Master in Integrated Management Systems: Quality, Environment and Safety, School of Technology, IPCA (supervisor: Vilhena, E.)

Letícia Correia Fortes, Otimização de um sistema de gestão alimentar de acordo com o British Retail Consortium (BRC) numa Cooperativa de pequenos frutos, Master in Integrated Management Systems: Quality, Environment and Safety, School of Technology, IPCA (supervisor: Vilhena, E.)

Miguel Ferreira, Fatores explicativos da evolução do preço de mercado e da rentabilidade das ações: Evidência empírica para a Euronext Lisbon, Master in Organizational Management, School of Management, IPCA (supervisor: Vilhena, E.)

Patrícia Cibrão, Gestão dos Riscos Psicossociais nas Organizações: aplicação do COPSOQ II, Master in Integrated Management Systems: Quality, Environment and Safety, School of Technology, IPCA (supervisor: Vilhena, E.)

Sara Duarte, Fatores determinantes do endividamento: Evidência empírica para as empresas não financeiras cotadas na Euronext Lisbon, Master in Organizational Management, School of Management, IPCA (supervisor: Vilhena, E.)

Tânia Patrícia Antunes Oliveira, A Influência das Auditorias Internas em Segurança e Saúde no Trabalho no Desempenho Organizacional, Master in Integrated Management Systems: Quality, Environment and Safety, School of Technology, IPCA (supervisor: Vilhena, E.)

Vitor Moreira, O impacto da Contratação Pública na Economia Local, Master in Organizational Management, School of Management, IPCA (supervisor: Vilhena, E.)

Helena Correia, SmartPhoneHeadScanner, Master in Electronic and Computer Engineering, School of Technology, IPCA (supervisor: Brito, J.H.)

João Marcelo Arantes, PHONEPOSETRACKING, Master in Electronic and Computer Engineering, School of Technology, IPCA (supervisor: Brito, J.H.)

Diogo Pontes, FirstRowVideoSpotter: Análise de video de transmissões televisivas de eventos desportivos, Master in Electronic and Computer Engineering, School of Technology, IPCA (supervisor: Brito, J.H.)

João Rodrigues, RAID.Video - Tracking de jogadores, Master in Electronic and Computer Engineering, School of Technology, IPCA (supervisor: Brito, J.H.)

Hugo Sousa, SatSuperRes: Desenvolvimento de uma aplicação de Super resolução para imagens satélite, Master in Electronic and Computer Engineering, School of Technology, IPCA (supervisor: Brito, J.H.)

Sérgio Gomes, SatFire3: Estimativa de área ardidas com base em imagens satélite, dados geográficos e meteorológicos, Master in Electronic and Computer Engineering, School of Technology, IPCA (supervisor: Brito, J.H.)

Pedro Apolinário, SatForest: Classificação Hierárquica com base em imagens de satélite, Master in Electronic and Computer Engineering, School of Technology, IPCA (supervisor: Brito, J.H.)
Diogo Vale, Deep Learning Network Compression for Android systems, Master in Electronic and Computer Engineering, School of Technology, IPCA (supervisor: Brito, J.H.)
Pedro Guimarães, StonePuzzle, Master in Electronic and Computer Engineering, School of Technology, IPCA (supervisor: Brito, J.H.)

Raúl Ribeiro, Segmentation and Classification of Breast Tissue in Mammograms, Master in Electronic and Computer Engineering, School of Technology, IPCA (supervisors: Morais, P. and Vilaça, J. L.)

António Real, Robot-assisted Breast Biopsy, Master in Electronic and Computer Engineering, School of Technology, IPCA (supervisors: Morais, P. and Vilaça, J. L.)

Rafael Fernandes, A new framework for the planning of left atrial appendage oclusion in 2D Ultrasound imaging, Master in Electronic and Computer Engineering, School of Technology, IPCA (supervisors: Morais, P. and Vilaça, J. L.)

Ivo Dias, Sustained health monitoring using hardware focused on interactive activities, Master in Electronic and Computer Engineering, School of Technology, IPCA (supervisors: Morais, P. and Vilaça, J. L.)

Carlos Oliveira, Procedural level generation based on probabilistic grammars, Master in Engineering of Digital Games Development, School of Technology, IPCA (supervisor: Simões A.)

Gabriel Peixoto, Voxel Terrain Generation, Master's in Engineering of Digital Games Development, School of Technology, IPCA (supervisor: Simões A., Duque, D.)

Pedro Almeida, Combining Curriculum Learning and Behaviour Cloning to train a First-person Shooter Agents., Master in Engineering of Digital Games Development, School of Technology, IPCA (supervisor: Simões A.)

Rui Meira, ChatbotWizard - O Orquestrador de Chatbots, Master in Computer Engineering, University of Minho (supervisor: Simões A.)

Rui Meira, Abstract Syntax Tree Type Annotation, Master in Computer Engineering, University of Minho (supervisor: Simões A.)

João Teixeira, Enhancing the comprehension of an atom with the use of VR for 9th grade students, Master in Engineering of Digital Games Development, School of Technology, IPCA (supervisors: Oliveira, E. and Miranda, D.)

Ana Almeira, AI SAFERCOBOT 4.0 - Sistema de visão inteligente para células de trabalho colaborativas, Master in Electronics and Computer Engineering, School of Technology, IPCA (supervisor: Moreira, A.)

João Faria, Autonomous mobile robot for transporting wheelchairs in healthcare institutions, Master in Electronics and Computer Engineering, School of Technology, IPCA (supervisor: Moreira, A.)

Luis Martins, Adapative eletrostatic adhesion gripper for textile materials, Master in Electronics and Computer Engineering, School of Technology, IPCA (supervisor: Moreira, A.)
Andreia Mendes, Desenvolvimento de aplicação em realidade virtual para o tratamento de pacientes com esquizofrenia, Master in Engineering of Digital Games Development, School of Technology, IPCA (supervisors: Duque, D.and Carvalho, V.)

Diogo Pereira, Realidade Virtual como Ferramenta para Reabilitação, Pós-AVC, dos Membros Superiores, Master in Engineering of Digital Games Development, School of Technology, IPCA (supervisors: Duque, D., Carvalho, V.)

Eduardo Santos, Desenvolvimento de Conteúdos para Videojogos: A Importância da ligação entre jogador e personagem no media interativo, Master in Illustration And Animation, School of Design, IPCA (supervisors: Duque, D. and Albino, M.)

Rafael Silva, Ambientes Digitais e Interativos em Realidade Virtual para crianças com Autismo, Master in Engineering of Digital Games Development, School of Technology, IPCA (supervisors: Duque, D. and Melo, M.)

Rui Luz, Automatic Modeling of sketches as a Fast Prototyping Tool for Game Design, Master in Engineering of Digital Games Development, School of Technology, IPCA (supervisors: Duque, D. and Oliveira, E.)

David Jorge, A Aplicação de Jogos Sérios no Ensino da Física, Master in Engineering of Digital Games Development, School of Technology, IPCA (supervisors: Duque, D. and Miranda, D.)

Ricardo Martins, Melhoria do desempenho de uma organização recorrendo à implementação do Sistema de Gestão Ambiental, Master in Integrated Management Systems: Quality, Environment and Safety, School of Technology, IPCA (supervisors: Pereira, M., Miranda, D.)

Nello Orsolon, Augmented Reality for Robot Interaction, Master in Illustration And Animation, School of Design, IPCA (supervisors: Duque, D. and Simões A.)

Flávio Lima, Mobeybou: Investigation of Children's Playful Interactions using Mobeybou Tools, Master in Illustration And Animation, School of Design, IPCAA (supervisors: Duque, D. and Sylla C.)

Jonas Gomes, O ambiente como meio transmissor de emoções no universo dos videojogos, Master in Illustration And Animation, School of Design, IPCA (supervisors: Duque, D. and Ferreira, A.)

Afonso Almeida, Paranoid OS: Wearable trackers, Master in Informatics Engineering, School of Technology, IPCA. (Supervisor: Lopes,N., Coelho, N.)

Rui Ferreira, Software test automation using AI based tools, Master in Informatics Engineering, School of Technology, IPCA. (Supervisor: Lopes,N., Vilas Boas, J.)

Tiago Oliveira, Analysis and comparison of automatic paralelization tools, Master in Informatics Engineering, School of Technology, IPCA. (Supervisor: Lopes, N.)

Ricardo Machado, Job-Shop Scheduling using Reinforcement Learning, Master in Informatics Engineering, School of Technology, IPCA. (Supervisor: Lopes, N., Gonçalves, J.)
Luís Araújo, Estudo de Ferramentas para Deteção de Vulnerabilidades em Código-fonte, Master in Informatics Engineering, School of Technology, IPCA. (Supervisor: Lopes, N., Silva, J.C.)

Jaime Rodrigues, Estudo do impacto nos controladores na implementação de mecanismos contra ataques DoS em redes SDN, Master in Informatics Engineering, School of Technology, IPCA. (Supervisor: Lopes, N., Chagas, S.)

Davide Azevedo, Estudo do impacto nos controladores na implementação de mecanismos contra ataques DoS em redes SDN, Master in Informatics Engineering, School of Technology, IPCA. (Supervisor: Lopes, N., Silva, J.C.)

Ricardo Rodrigues, Optimização e desenvolvimento de sensores capacitivos aplicados em dispositivos de monitorização de reabilitação física, Master in Electronics and Computer Engineering, School of Technology, IPCA (supervisor: Miranda, D., Vilaça, J.L.)

Ângela Daniela Oliveira Fontes, Participação Variável em IRS: Perceção da Comunidade IPCA, Master's in Organizational Management, School of Management, IPCA (supervisor: Vilhena, E.)

Helena Pereira, Avaliação de Riscos Psicossociais em Contexto do Ensino Superior Politécnico, Master's in Integrated Management Systems: Quality, Environment and Safety, School of Technology, IPCA (supervisor: Vilhena, E.)

Rita Feitas, Análise dos Fatores Explicativos do Nível de Endividamento: Evidência Empirica para as Empresas Não Financeiras Portuguesas, Master's in Organizational Management, School of Management, IPCA (supervisor: Vilhena, E.)

João Petersen, Game Mechanics Influenced by Biometric Sensors, Master in Engineering of Digital Games Development, School of Technology, IPCA (co-supervisor: Carvalho, V.)

Pedro Sanches, Simulador de Realidade Virtual – Top Gun Analysis, Master in Engineering of Digital Games Development, School of Technology, IPCA (supervisor: Carvalho, V.)

Paulo Barbosa, Classificação de Técnicas de Taekwondo com Recurso a Processamento de Imagem e Machine Learning, Master in Electronic and Computer Engineering, School of Technology, IPCA (supervisor: Carvalho, V.)

Rui Filipe Oliveira, Simulador Debriefing em Realidade Virtual, Master in Informatics Engineering, School of Technology, IPCA. (supervisor: Carvalho, V.)

Rute Carvalho, Desenvolvimento de uma Plataforma Digital de Gestão de Roupa para Pessoas com Deficiência Visual, Master in Digital Design, School of Design, IPCA. (co-supervisor: Carvalho, V.)

Fábio Ferreira, Monitorização de Técnicas de Taekwondo, Master in Mechatronics Engineering, University of Minho. (co-supervisor: Carvalho, V.)

Luís Silva, Development of a Mechatronic System to Identify and Manage Clothing Items for Blind People, Integrated Master's Degree in Industrial Electronics and Computer Engineering, University of Minho. (co-supervisor: Carvalho, V.)

Olga Cerqueira, A metodologia A3 problem solving na gestão de reclamações, Master in Integrated Management Systems: Quality, Environment and Safety, School of Technology, IPCA (supervisor: Moreira, A.)

Ana Almeida, Ai SaferCobot 4.0, Master in Electronics and Computer Engineering, School of Technology, IPCA (supervisor: Moreira, A.)

Rui Oliveira, Sistema Não Invasivo de Medição de Frequência Respiratória em Bebés, Master in Electronics and Computer Engineering, School of Technology, IPCA (supervisors: Carvalho, V., Simões, R.)

Nélson Faria, Cancer Detec – Lung Cancer Diagnosis, Master in Electronics and Computer Engineering, School of Technology, IPCA (supervisors: Carvalho, V.)

José Roberto Rodrigues Rosa, Plataforma Web de Gestão de demonstradores-piloto (Living Labs), Master in Computer Engineering, School of Technology, IPCA (supervisor: Pedro J., Ferreira L.)

Fábio Ferreira, Reconhecimento Facial Condicionado – Impacto da ocultação por máscaras e outros adereços, Master in Computer Engineering, School of Technology, IPCA (supervisor: Ferreira L., Pedro J.)

José Vale, Benchmarking de Arquiteturas Orientadas a Serviços em .NET – Estudo Comparativo entre REST, GraphQL e gRPC, Master in Computer Engineering, School of Technology, IPCA (supervisor: Ferreira, L.)

Andreia Oliveira, Avaliação de Usabilidade em Aplicações Interativas de Moda com Recurso a Realidade Aumentada, Master in Computer Engineering, School of Technology, IPCA (supervisor: Martinho J., Ferreira, L.)

Helena Brandão, Distributed Graph Databases: Estudo e Avaliação, Master in Computer Engineering, School of Technology, IPCA (supervisor: Quintela H., Ferreira, L.)

André Costa, Dynamic and Flexible Integration Dashboard-IoT, Master in Computer Engineering, School of Technology, IPCA (supervisor: Ferreira, L.)

Cristóvão Emanuel Faria Costa, Advanced Trekking Indicator, Master in Computer Engineering, School of Technology, IPCA (supervisor: Ferreira, L.)

Ivo Gomes, Webhooks: Asynchronous Communication through the HTTP Protocol, Master in Computer Engineering, School of Technology, IPCA (supervisor: Ferreira, L.)

José Oliveira, Previsão da interação com Sistemas de Informação, Master in Computer Engineering, School of Technology, IPCA (supervisor: Carlos, J., Ferreira, L.)

Pedro Ribeiro, Análise de Sentimento em Língua Portuguesa, Master in Computer Engineering, School of Technology, IPCA (supervisor: Simões, A., Ferreira, L.)

Ricardo Sabino, Smart Contracts applications within Blockchain technology: A proposal, Master in Computer Engineering, School of Technology, IPCA (supervisor: Ferreira, L.)
Pedro Cerqueira, Descentralized Bookmaker, Master in Computer Engineering, School of Technology, IPCA (supervisor: Ferreira, L.)

Pedro Sousa, Geolocalização na IOT para atividades ao ar livre, Master in Computer Engineering, School of Technology, IPCA (supervisor: Ferreira, L.)

Michael Matias, IoT Low Frequency Tracking Platform, Master's in Computer Engineering, School of Technology, IPCA (supervisor: Ferreira, L.)

Eduarda Araújo, A Era Digital na Gestão de Recursos Humanos: Impacto na produtividade das PME de Portugal, Master in Management, Human Resources Management branch, School of Management, IPCA (supervisor: Melo, P., Ferreira, L.)

Ariana Igreja, StressMonitor, Master in Computer Engineering, School of Technology, IPCA (supervisor: Gonçalves, J.)

Agostinho Silva, Plataforma de Business Analytics para Micro e Pequenas Empresas, Master in Informatic Engineering, School of Technology, IPCA (supervisor: Gonçalves, J., Silva, J.)

José Carneiro, Artificial intelligence tattoo removal treatment planning for collaborative robotic-based treatments, MSc in Industrial Electronics and Computers Engineering, University of Minho & Algoritmi & 2Ai IPCA (supervisor: Vilaça, J. L.)

Bruno Duarte, Robust 3D breast reconstruction and localization based on artificial intelligence for robotic guided oncological interventions, MSc in Biomedical Engineering, University of Minho & Algoritmi & 2Ai IPCA (supervisor: Vilaça, J. L.)

Margarida Ferreira, Breast Tumor Segmentation and Classification using Deep Learning Method, Master in Informatic Engineering, School of Technology, IPCA (supervisor: Vilaça, J. L.).

Bachelor final projects

Pedro Ferreira, Satfire 2, Creation of wildfires dataset and attempt to predict the burned areas with semantic segmentation, Bachelor's degree in Electrical and Computer Engineering, School of Technology, IPCA (supervisor: Brito, J.H.)

Bruno Patrício, SoccerObjects - Object detection in soccer games, Bachelor's degree in Electrical and Computer Engineering, School of Technology, IPCA (supervisor: Brito, J.H.)

João Azevedo, SoccerPlayerParser, Bachelor's degree in Electrical and Computer Engineering, School of Technology, IPCA (supervisor: Brito, J.H.)

Miguel Marques, Hierarchical Line Extremity Segmentation U-Net for the SoccerNet 2022 Calibration Challenge - Pitch Localization, Bachelor's degree in Electrical and Computer Engineering, School of Technology, IPCA (supervisor: Brito, J.H.)

Diogo Nunes, SatForest - Detecção de floresta em Portugal Continental em base de imagens de satélite e Deep Learning, Bachelor's degree in Electrical and Computer Engineering, School of Technology, IPCA (supervisor: Brito, J.H.)
David Morim, Natural Stone Image Classification using Convolutional Neural Networks, Bachelor's degree in Electrical and Computer Engineering, School of Technology, IPCA (supervisor: Brito, J.H.)

Carlos Santos, Inspecção Visual Automática de Artigos Têxteis, Bachelor's degree in Electrical and Computer Engineering, School of Technology, IPCA (supervisor: Brito, J.H.)

André Meira, Super Resolution for Satellite Imagery, Bachelor's degree in Electrical and Computer Engineering, School of Technology, IPCA (supervisor: Brito, J.H.)

João Silva, SatForest2 - Land use and land cover classification with satellite imagery and Deep Learning, Bachelor's degree in Electrical and Computer Engineering, School of Technology, IPCA (supervisor: Brito, J.H.)

João Reis, PcBodyScanner, Bachelor's degree in Electrical and Computer Engineering, School of Technology, IPCA (supervisor: Brito, J.H.)

Margarida Oliveira, Normalização do processo produtivo, Bachelor's degree in Industrial Engineering and Management, School of Technology, IPCA (supervisor: Miranda, D.)

José Sá, Projeto de Estágio: CAN FD, Bachelor's degree in Electrical and Computer Engineering, School of Technology, IPCA (supervisor: Morais, P.)

Paulo Costa, Desenvolvimento de um método de Deep Learning para segmentação do apêndice auricular esquerdo em imagens de TC 3D. Bachelor's degree in Electrical and Computer Engineering, School of Technology, IPCA (supervisors: Morais, P. and Vilaça, J. L.)

Tiago Sousa, HMI to Cold Forging Machine via Piezoeletric Sensors. Bachelor's degree in Electrical and Computer Engineering, School of Technology, IPCA (supervisor: Dias, N.)

Rui Rodrigues, Eletrificação de uma máquina industrial. Bachelor's degree in Electrical and Computer Engineering, School of Technology, IPCA (supervisor: Moreira, A.)

Diogo Araújo, EcoLearn - Jogo de Educação Financeira. Bachelor's degree in Electrical and Computer Engineering, School of Technology, IPCA (supervisor: Duque, D.)

Pedro Gomes, Desenvolvimento de um software para central de incêndios endereçável. Bachelor's degree in Electrical and Computer Engineering, School of Technology, IPCA (supervisor: Duque, D.)

Alexandre Ramos, MyEyes - Tag. Bachelor's degree in Electrical and Computer Engineering, School of Technology, IPCA (supervisor: Carvalho, V.)

João Silva, Automation of Advanced Optoelectronic Measurements. Bachelor's degree in Electrical and Computer Engineering, School of Technology, IPCA (supervisor: Carvalho, V.)

Luís Ferreira, MyEyes Eletrical Car - Desenvolvimento de uma ferramenta para a deteção de carros elétricos em tempo real para cegos. Bachelor's degree in Electrical and Computer Engineering, School of Technology, IPCA (supervisor: Carvalho, V.)

Tiago Teixeira, Ai Robot Picker. Bachelor's degree in Electrical and Computer Engineering, School of Technology, IPCA (supervisor: Moreira, A.)

Joao Cunha, Flash Station – Desenvolvimento de uma estação de atualização e teste de dispositivos de infoentretenimento. Bachelor's degree in Electrical and Computer Engineering, School of Technology, IPCA (supervisor: Moreira, A.)

Daniel Gonçalves, Automation Data Connector for i4.0. Bachelor's degree in Electrical and Computer Engineering, School of Technology, IPCA (supervisor: Moreira, A.)

Luís Queirós, Automatização de uma Máquina CMM. Bachelor's degree in Electrical and Computer Engineering, School of Technology, IPCA (supervisor: Moreira, A.)

Prizes

Winner of the "Students & Young Professionals" from IES-SYPA Contest in IECON 2022 through the work: Pereira, S.G, Morais, P., Veloso, F., Moreira, A.H.J., Miranda, D. Machado, J., Martins, J. and Vilaça, J.L. (2022). Insertion of RFID tags into plastic parts using ultrasonic welding. In In *IECON 2022–48th Annual Conference of the IEEE Industrial Electronics Society* (pp. 1-6). *(ISI/Scopus indexed International Conference Paper).*

2Ai members: Morais P., Moreira, A. H. J., Miranda, D., Vilaça, J. L.

"LaserNAVI - Navigation system based on medical robots for intelligent laser therapies", **Winner Knowledge Circle vouchers contest:** This event was held in October, 2022. The target audience were researchers and the academic community of IPCA and IPLeiria. The aim was to recognize and support technical solutions (TRL 5-6 or technical solutions protected by IPR), moving into further stages of development and commercialization. https://knowledgecircle.pt/concurso/.

2Ai members: Morais P., Vilaça, J. L.

4. FUNDING

4.1 FUNDING APPLICATION

4.1.1. R&D Industrial Projects in National Calls

Pacto de Inovação "HfPT – Health from Portugal"
Call: Grant N.º 01/C05-i01/2021
2Ai Members: João L. Vilaça, Vitor Carvalho, Pedro Morais, António Moreira, Duarte Duque
Requested Funding to 2Ai: 1.232.528,72€
R&D Partners: Prológica
Status: Accepted.

AM2R - Agenda Mobilizadora para a inovação empresarial do setor das Duas Rodas
Call: Grant N.º 01/C05-i01/2021
2Ai Members: António Moreira (PI), João Vilaça, Pedro Morais, Duarte Duque, José Brito
Requested Funding to 2Ai: 766.205,67€
R&D Partners: Sistrade
Status: Accepted.

FAIST – Fábrica Ágil, Inteligente, Sustentável e Tecnológica
Call: Grant N.º 01/C05-i01/2021
2Ai Members: Duarte Duque, João Vilaça
Requested Funding to 2Ai: 149.964,10€
R&D Partners: CARITÉ - CALÇADOS, LDA
Status: Accepted.

Standard Asset Administration Shell Protocols for IT/OT Integration
Call: EIT Manufacturing - call 23035
2Ai Members: António Moreira, João Vilaça, Pedro Morais, José Brito
Requested Funding to 2Ai: 196.886,00€
R&D Partners: INESC TEC, Santer Reply SA, Marposs SPA, FoodinTech Lda
Status: Not Recommend for Funding.

Agenda para a construção industrial sustentável
Call: Grant N.º 01/C05-i01/2021
2Ai Members: João L. Vilaça (PI), António Moreira, Pedro Morais, Duarte Duque, Daniel Miranda, André Carvalho, João Fonseca
Requested Funding: 1.319.941,19€
R&D Partners: Casais

Status: Not Recommended for Funding.

4.1.2. R&D Projects in national calls

Three dimensional printed Batteries for Advanced Electronics Applications
Call: FCT I&D Projects
2Ai Members: Daniel Miranda, João L. Vilaça
Requested Funding to 2Ai: 22.274,60€
R&D Partners: Centro de Física da Universidade do Minho and Centro Requenti da Universidade Nova de Lisboa
Status: Accepted.

Design and embodiment of wearable prostheses
Call: FCT I&D Projects
2Ai Members: Daniel Miranda (Co-PI), Vitor Carvalho
Requested Funding to 2Ai: 0 €
R&D Partners: ID+/IPCA (Leader)
Status: Accepted.

Predictive quality and operational excellence for the production cycle
Call: FCT I&D Projects
2Ai Members: André Carvalho, António Moreira e Estela Vilhena
Requested Funding to 2Ai: 73.234,1€
R&D Partners: Universidade do Minho
Status: Not recommended for funding.

SUSTER - Sustentabilidade dos sistemas socio-ecológicos de montanha: o conhecimento dos ecossistemas e recursos endógenos na promoção de soluções de valorização lideradas localmente
Call: Grant N.º 10/ C05-i03/2021
2Ai Members: Luís Ferreira (PI), Joaquim Gonçalves
Requested Funding to 2Ai: 105.344,03€
R&D Partners: IPVC, IPG, CIM Alto Minho, Federação Nacional das Associações de Raças Autóctones, Associação de Criadores de Ruminantes da Guarda, Associação de Desenvolvimento Rural Integrado do Vale do Minho, Associação de Desenvolvimento Integrado da Raia Centro Norte, Pólo de Inovação de Braga.
Status: Not Recommended for Funding.

Sistema de Navegação Robótica com Inteligência Artificial para Tratamentos Laser de Lesões Vasculares
2Ai Members: João Vilaça (PI), Pedro Morais, António Moreira
Call: FCT I&D Projects
Requested Funding: 249.868,98 €
Status: Not Recommended for Funding.

SmartLAAC - Smart image-based system for device implantation planning, sizing and guidance in Left Atrial Appendage Closure

2Ai Members: Pedro Morais (PI), João Vilaça, António Moreira
Call: FCT I&D Projects
Requested Funding: 249.924,26€
Requested Funding to 2Ai: 204.493,78€
R&D Partners: ICVS/3B's Associated Laboratory PT, CUHK, Hospital de Gaia, UKBonn and KULeuven
Status: Not Recommended for Funding.

SPERTA - Real-time Performance Assessment System for High-Competition Taekwondo Athletes
2Ai Members: Vitor Carvalho (PI)
Call: FCT I&D Projects
Requested Funding to 2Ai: 245.072,00€
R&D Partners: UMinho.
Status: Not Recommended for Funding.

Embedded Energy-Aware Architecture Search for efficient tinyML applications in low-power edge devices
2Ai Members: António Moreira (PI), João Vilaça, José Brito
Call: FCT I&D Projects
Requested Funding to 2Ai: 49.289,20€
Status: Not Recommended for Funding.

4.1.3. European Projets

CoSMO PRP
Call: Eureka GlobalStars Brazil
2Ai Members: João L. Vilaça (PI), Estela Vilhena, Daniel Miranda, José Brito, Duarte Duque, Pedro Morais
Requested Funding: 3.000.000,00€
Requested Funding to 2Ai: 799.851,05€
R&D Partners: Hydrumedical, Sintegra, ElDorado
Status: Under Evaluation.

LaserNAVI - Robot-assisted laser guided therapy
Call: CaixaResearch Validate
2Ai Members: João L. Vilaça (PI), Pedro Morais
Requested Funding: 100.000,00€
Status: Not Recommended for Funding.

4.1.5. Services

FUEL - Development of a clustering methodology to find patterns and correlations between human performance indicators
Industrial Partner: Deloitte
2Ai Members: João L. Vilaça
Requested Funding to 2Ai: 16.139,70€
Status: Under Execution.

SmartDrawer - Sistema eletromecânico automatizado para o movimento da gaveta da consola central de um automóvel
Industrial Partner: Lucemplast
2Ai Members: João L. Vilaça and Pedro Morais
Requested Funding to 2Ai: 34.000,00€
Status: Under Execution.

Fly London Experience
Industrial Partner: KYAIA - Fortunato O. Frederico & Ca Lda.
2Ai Members: Duarte Duque
Requested Funding to 2Ai: 5.996,25€
Status: Completed.

SILVA - Sistema Integrado Localização Vespa Asiátia - NUTS III Cávado
Industrial Partner: CIM Cávado.
2Ai Members: Luís Ferreira
Requested Funding to 2Ai: 92.250,00€
Status: Not started.

4.2 FUNDING COLLECTED

4.2.1. I&D project - Public call

Pacto de Inovação "HfPT – Health from Portugal" - PPS3
Aims: This project is a large national consortium with 96 partners including both companies, R&D units and interface centers. The different partners will be divided in small mini-consortium targeting the implementation of new products in health research areas. Particularly, 2Ai members are inserted into the PPS3 of SmartHealth research line, targeting the implementation of new devices for medical diagnosis, signals monitoring and investigation on serious games.
Principal Investigator in 2Ai: João L. Vilaça
Reference: Grant N.º 01/C05-i01/2021
Period: 2022-2025.
Total Funding: 889.052,06€

Pacto de Inovação "HfPT – Health from Portugal" - PPS4
Aims: This project is a large national consortium with 96 partners including both companies, R&D units and interface centers. The different partners will be divided in small mini-consortium targeting the implementation of new products in health research areas. Particularly, 2Ai members are inserted into the PPS4 of the SmartHealth research line, targeting the research on AI system in healthcare.
Principal Investigator in 2Ai: Pedro Morais
Reference: Grant N.º 01/C05-i01/2021
Period: 2022-2025.
Total Funding: 109.550,23€

Pacto de Inovação "HfPT – Health from Portugal" - PPS5
Aims: This project is a large national consortium with 96 partners including both companies, R&D units and interface centers. The different partners will be divided in small mini-consortium targeting the implementation of new products in health research areas. Particularly, 2Ai members are inserted into SmartHealth research line, targeting the implementation of new devices for vital signals monitoring and research of AI in healthcare.
Principal Investigator in 2Ai: Vítor Carvalho
Reference: Grant N.º 01/C05-i01/2021
Period: 2022-2025.
Total Funding: 233.926,43€

AM2R - Agenda Mobilizadora para a inovação empresarial do setor das Duas Rodas
Aims: The Mobilizing Agenda for business innovation in the Two-Wheeled Sector aims to operationalize the intervention in priority areas in the value chain that will transform the national production profile and develop a new specialization profile in the sector to leverage its competitive position in the international market, focusing on independence from the Asian market, through the development and endogenization of advanced knowledge around new products, processes and services, increasing and differentiating national productivity and enhancing the dissemination of technological knowledge based on sustainability and digitalization. Thus, the main objective of the Agenda is to consolidate and expand the link between the business fabric and the scientific and technological system in order to increase the competitiveness and resilience of the sector based on research and technological development, innovation and diversification of the productive structure of products and services.
Principal Investigator in 2Ai: António Moreira
Reference: Grant N.º 01/C05-i01/2021
Period: 2022-2025.
Total Funding: 742.154,74€

FAIST – Fábrica Ágil, Inteligente, Sustentável e Tecnológica
Aims: The FAIST project - Factory Agile, Intelligent, Sustainable and Technological is promoted by a consortium of 35 companies and entities linked to the footwear and leather goods cluster and has as main objective to provide and empower this industry with innovative technologies, processes and sustainable materials, increasing the responsiveness to market requirements and make the Portuguese footwear and leather goods industry the most modern in the world. IPCA will be a partner in the creation of the digital platform TUTORIC - Platform of Scientific Content for Personalized Learning, to be developed by Expandindustria in partnership with INESC TEC. TUTORIC aims to create an electronic platform for vocational training and new digital content to fill skills gaps in users of new technologies, using artificial intelligence in the definition of personalized training paths and peer review of new content.
Principal Investigator in 2Ai: Duarte Duque
Reference: Grant N.º 01/C05-i01/2021
Period: 2022-2025.
Total Funding: 149.964,10€

Three dimensional (3D) printed BATteries for ADvanced ELectronics applications
Aims: The focus of this project is to produce new 3D micro lithium-ion batteries and among other types, through the Fused Filament Fabrication (FFF) technique based on solid-state ion conductors and optimized additive manufacturing properties for achieving high bulk conductivity and facilitating low interface resistances through the control of printability (rheological properties) and electrochemical performance that are two important parameters which should be simultaneously guaranteed.
Principal Investigator in 2Ai: Daniel Miranda
Reference: 2022.03931.PTDC
Period: 2022-2024.
Total Funding: 22.274,60€

Design and embodiment of wearable prostheses
Aims: This exploratory research project is part of the scientific area of Design and focuses on research, design, development and testing of the use of medical devices, more precisely wearable myoelectric prostheses for upper limbs. Prostheses are medical devices whose purpose is to restore an absent bodily function, caused by the loss or congenital malformation of a body part. In case of upper limb, we can observe a very reduced evolution compared to solutions for other body segments. This project will focus on a category of active prostheses: myoelectric prostheses, which are models whose control is carried out through the myoelectric signal (SME) from muscle contraction, that is, through surface electromyography (sEMG, Surface Electromyography).
Principal Investigator in 2Ai: Daniel Miranda (Co-PI)
Reference: 2022.09053.PTDC

Period: 2022-2024.
Total Funding: 0€

5. Short Advanced Programs

Data Analysis

Description: This short advanced program targeted the following topics, namely: sensitize participants about the importance of extracting knowledge from unstructured data, especially when the data volume is very large; provide knowledge of the main data analysis techniques using statistical software; formulate and solve problems, interpret results based on statistical tools, related to: forecasting models, reducing data complexity, classifying and grouping objects or variables; understand the concept of machine learning and select the most appropriate models for each problem and develop logical and deductive reasoning; increase critical spirit, develop analytical and creative ability.
2Ai Members: Estela Vilhena (2Ai-IPCA) and Joaquim Gonçalves (2Ai-IPCA)
Date: November 2022
Organization: 2Ai-IPCA
Webpage: https://2ai.ipca.pt/advanced-courses/data-analysis/

Go for a Digital Product

Description: This Short Advanced Programme (SAP) from RUN-EU brings together engineering and design students to improve people's lives. The programme invites participants to explore the possibilities of digital technology to advance physical health. The participants learn how to apply design thinking in digital product development and how to run an innovation process in an international multidisciplinary team. The students gain knowledge of the specific technology to be used in the design challenge and learn critical elements in the nexus of technology and design.

2Ai Members: António Moreira (2Ai-IPCA)
Date: April 4th - May 13th 2022
Organization Leader: HAMK and 2Ai-IPCA
Webpage: https://run-eu.eu/2022/02/14/sap-go-for-a-digital-product/

Challenging Game Development

Description: This Short-Advanced Programme is an introductory course for digital game development, covering the whole game development lifecycle, from the ideation to its analysis, creation of a storyboard, preparing assets, codifying the game logic, and testing. These topics will be addressed at a high level, allowing attendees to understand the different development phases, and how they integrate into a game project.
2Ai Members: Alberto Simões (2Ai-IPCA) and Duarte Duque (2Ai-IPCA)
Date: May 9th - May 20th, 2022
Organization Leader: NHL Stenden and 2Ai-IPCA
Webpage: https://run-eu.eu/2022/03/31/sap-challenging-game-development/

6. Ph.D.'s and Master Degrees

In 2022, the Doctoral Programme in Games and Creative Technologies started its first edition in September 2022 with a total of 7 students. This doctoral programme is a collaboration between 2Ai and School of Technology from IPCA and UNIDCOM and Faculty of Design, Technology and Communication from European University. The proposed doctoral program explores the interdisciplinarity of video games and digital entertainment, aiming to provide advanced and specialized training.

Moreover, the Professional Master's degree in Supporting Technologies for STEAM Education was recognized by by the Portuguese Higher Education Evaluation and Accreditation Agency. The first edition of this master is expected to start in October 2023. This master program aims to train its students to study a set of technologies that enable them to develop digital educational resources, with a view to their inclusion in the teaching and learning processes. This master also explores a strategic collaboration with the University of HAMK, Finland (RUN-EU partner), with vast experience in innovative pedagogical practices.

7. Research Collaboration Agreements

The following protocols were established in 2022:

Joint-PhD with TUS: A memorandum of understanding between TUS and IPCA regarding the operation of joint research PhD programmes in relevant discipline areas with an equivalence ECTS (European Credit Transfer System as appropriate), hereinafter referred to as RUN-EU European University PhDs, offered in association between the two institutions. TUS and IPCA will collaborate on the development of joint PhD Programmes. These joint PhD programmes will lead to a single award with the awarding of a doctorate under the awarding powers of TUS. The joint character of the PhD programmes will be reflected appropriately in the award documentation. These joint PhD programmes will be established in the areas of Technology, Design, Management, Marketing, Health and Sport.

8. Scientific Recruitment

8.1 Scholarships

During this year, 2Ai opened multiple tenders in order to increase the critical mass in the R&D unit. Different scholarship typologies, according to the researcher's degrees, were offered. A summary of the research opportunities can be found in Table 2. All scholarships were funded by ongoing projects in the R&D. Research positions in all scientific levels (as defined by the Portuguese Foundation for Science and Technology) were offered.

Table 2 - Number of scholarship tenders opened in 2022

Scholarship	Nº of Positions
Research initiation scholarship	0
Research scholarship for bachelors	16
Research scholarship for masters	8
Ph.D. scholarships	1
Post-doctoral scholarships	4

8.2 Scientific Employment

In line with the previous years, 2Ai pursued its strategy to recruit PhD researchers in accordance with national politics to promote research careers in Portugal, namely the Scientific Employment program.

Therefore, the following tenders were opened throughout 2022:

1. An international selection tender for recruitment in the form of an uncertain term contract concluded under the Labour Code, of 1 (one) Assistant Researcher position for the exercise of scientific research activities in the scientific area of Engineering, Artificial Intelligence and Biomedical Sciences was opened. It was published in the Portuguese Diary of the Republic, 2nd Serie, nº 83, with reference 8731/2022. This position was opened under the project SAFHE - Safe Health Elderly Monitoring, operation no. Norte-01-0247-FEDER-070200.
2. An international selection tender for recruitment in the form of an uncertain term contract concluded under the Labour Code, of 1 (one) Junior Researcher position for the exercise of scientific research activities in the scientific area of Management, Economics, Law, Public Administration, International Relations, Communication, Education, Biomedical Engineering, Physics, Electronic Engineering, Mechanical Engineering, Industrial Engineering and Management, Systems Engineering, Computer Engineering and related areas was opened. It was published in the Portuguese Diary of the Republic, 2nd Serie, nº 184, with reference 18298/2022. This position was opened under the project Knowledge Circle, operation no. POCI-01-0246-FEDER-181295.

3. An international selection tender for recruitment in the form of an uncertain term contract concluded under the Labour Code, of 1 (one) Junior Researcher position for the exercise of scientific research activities in the scientific area of Eletronic Engineering, Informatic Engineering and related areas was opened. It was published in the Portuguese Diary of the Republic, 2nd Serie, nº 184, with reference 18299/2022. This position was opened under the project IMPACTTV - Impacto eMocional e Previsão de Audiências de Conteúdo na TV, operation no. NORTE-01-0247-FEDER-068574.

4. An international selection tender for recruitment in the form of an uncertain term contract concluded under the Labour Code, of 1 (one) Assistant Researcher position for the exercise of scientific research activities in the scientific area of Engineering, Artificial Intelligence and Biomedical Sciences and related areas was opened. It was published in the Portuguese Diary of the Republic, 2nd Serie, nº 184, with reference 18300/2022. This position was opened under the project OncoNAVIGATOR — Intelligent System for personalized navigation and mapping of oncological interventions, operation no. NORTE-01-0145-FEDER-00059.

5. An international selection tender for recruitment in the form of an uncertain term contract concluded under the Labour Code, of 1 (one) Junior Researcher position for the exercise of scientific research activities in the scientific area of Engineering, Artificial Intelligence and Biomedical Sciences and related areas was opened. It was published in the Portuguese Diary of the Republic, 2nd Serie, nº 184, with reference 18301/2022. This position was opened under the project IMPACTTV - Impacto eMocional e Previsão de Audiências de Conteúdo na TV, operation no. NORTE-01-0247-FEDER-068574.

8.3 Scientific Career

During 2022, 2Ai/IPCA opened, for the first time, one position for 1 (one) assistant PhD researcher in career. This documental international selection tender was open under the Labor Code for the Scientific Area of Eletrotechnical, Electronics and Computer Engineering, with a specialization in Medical Eletronics and Artificial Intelligence. It was published in the Portuguese Diary of the Republic, 2nd Serie, nº 146, with reference 1108-A/2022.

During the tender period, one application was received, which was selected for the Assistant Researcher position. The researcher initiated its activities in December 2022.

This scientific position is funded by the Portuguese Foundation for Science and Technology with operation no. CEECINST/00039/2021, under the Institutional Scientific Employment Stimulus Tender.

9. Associated Laboratory

Scientific Employment Stimulus Tender for Associated Laboratories

The Associated Laboratory of Intelligent Systems (LASI) submitted an application for the Scientific Employment Stimulus Tender for Associated Laboratories call (CEEC Associated Laboratories), promoted by the Portuguese Foundation for Science and Technology (FCT).

Under this application, a total of 10 R&D positions for Assistant PhD researcher, in career, was requested. The requested positions, if approved, will be funded by the FCT through a period of 6 years. The 10 positions, if approved, will be divided into the different members of LASI. One position is envisioned to the 2Ai Laboratory with the following profile:

TL3 - Health and Well-being

Scientific Area: Engineering and Technololgy

Sub-scientific Area: Eletrical, eletronics and computer science Engineering

Title: Artificial Intelligence for lifelong Personalized Patient Care: Intelligent Systems and Human-AI collaboration

The current tender is under evaluation and final decision is expected in 2023.

10. European Digital Innovation Hub

The ArTificial InTelligence and High-PeRformAnce CompuTing @ Portugal Digital Innovation Hub (ATTRACT DIH) brings together the main centers of competence in these technologies in Portugal, including Technological Interface Centers, a Collaborative Laboratory, Universities and Polytechnic Institutes. It includes the universities of Aveiro, Coimbra, Évora, Lisbon (FCiências.ID and Instituto Superior Técnico), Minho, Porto and Trás-os-Montes and Alto Douro, the Polytechnic Institutes of Cávado and Ave and Porto, the Iberian Institute of Nanotechnologies, the Pedro Nunes Institute, the National Civil Engineering Laboratory, DTx and INESC TEC.

Following its strategic plan, and after the national acceptance, the ATTRACT DIH consortium presented its application to integrate the European Network of Digital Innovation Poles (call DIGITAL-2021-EDIH-01). This integration aims of facilitating access to skills and experimentation infrastructure that do not exist in Portugal. The current proposal for integration as European Digital Innovation Hub was accepted.

Abstract of the proposal: Aligned and contributing for European and National policies, ATTRACT DIH defines an ambitious plan to support SMEs and public entities in their digital transformation and consolidation through the full exploitation of the synergetic potential between Artificial Intelligence and High-Performance Computing. ATTRACH DIH acts on both the supply and use of technology. The hub will support technology-based SMEs in the design, development, validation and internationalisation of new products and services that can strongly benefit from AI or HPC, aiming at significant sales volumes at international level. Complementary, the hub will foster and assist potentially adopters of AI or HPC based solutions with dissemination and support initiatives, including the maturity assessment and definition of adoption roadmaps, aiming at leapfrog productivity gains. To all recipients, ATTRACT will deliver specialized training services, fundraising support and will promote an active innovation ecosystem, including the collaboration with other DIHs at national and European level. To this end, ATTRACT DIH gathers the main AI and HPC research and technology-transfer centres in Portugal and their state-of-the-art experimental facilities, with a specific regional approach and coordination in the country main regions of the North, Centre, Lisbon and Tagus Valey, and South, complemented by two associations, the largest Business Association in Portugal and the Portuguese Data Science Association. ATTRACT members lead the four national HPC infrastructures and are National Competence Centres for HPC and related technologies from the EuroHPC JU EuroAccess network. As such, the hub is in a unique position to foster the utilisation of the HPC resources available in Portugal in general and to leverage them to enable the training of AI models that would not be feasible on-premises.

11. RUN-EU Regional University Network

Under the RUN-EU PLUS project, 2Ai/IPCA is co-leader of WP4 - "Strengthening Human Capital", with the following objectives:

- To identify current practices across the RUN-EU PLUS consortium and best practices within Europe as outlined in the charter and code in the deployment of human resource strategies for researcher career development.
- To introduce a 'Research Career Development Programme' adhering to the European charter and code principles to support our researchers in identifying clear personal career paths which will encourage inter-sectoral and international mobility during their careers and foster diversity and inclusiveness, including fostering gender equality and balance in research teams, to close the gaps in the participation of women.
- To introduce a research career evaluation system across the RUN-EU consortium to reward researchers and research excellence at all career development stages.
- To develop a cloud of knowledge portal equipping researchers with a combination of pedagogy and research skills. The European Charter regards Teaching as an essential means for the structuring and dissemination of knowledge and therefore considers it a valuable option within the researchers' career paths.

The Researcher Career Development Training Programme aims to support RUN-EU researchers in identifying their research skills and personal career paths and encourage inter-sectoral and international mobility, adhering to the European charter and code principles to support our researchers in identifying clear personal career paths which will encourage inter-sectoral and international mobility during their careers and foster diversity and inclusiveness, including fostering gender equality and balance in research teams, to close the gaps in the participation of women.

Postgraduate students, early-stage career researchers, research supervisors, staff supporting researchers and research stakeholders within RUN-EU were invited to participate in the workshops according to their interests. Each workshop was focused on different aspects of researcher skills, career paths and working environments, selected based on an initial audit performed through the RUN-EU network.

During 2022, the following workshops were organized for this training programme:

Open Science Workshop on Open Access (1st June 2022) - Online Event

- Topics: Advantages of open access; basic principles of open access; how to publish open access; open access and copyright;
- Organization: IPL and SZE.

Open Science Workshop on Fair Data (2nd June 2022) - Online Event

- Topics: Basic principles of research integrity; Writing a data management plan; Data protection in research; Findable, Accessible, Interoperable, Reusable Data;
- Organization: IPL and SZE.

Attractive Researcher Career Paths (9th June 2022) - Online Event

- Topics: Identification of researcher skills and competences and educational needs of researchers;
- Organization: HAMK;
- 2Ai Presenters: João L. Vilaça and Pedro Morais (Short Presentations)

How to be a successful Researcher (6th September 2022) - Online Event

- Topics: the publishing process and how to cope with its identified challenges; and impact of collaboration in writing a research funding proposal.
- Organization: HAMK;
- 2Ai Presenters: João L. Vilaça and Pedro Morais (Facilitators in Break-out rooms)

Approaches to early-stage researcher supervision (20th September 2022) - Online Event

- Topics: the roles and tasks of supervisors and postgraduate students in the supervision process; and best practices in supervision in various supervision environments.
- Organization: HAMK;
- 2Ai Presenters: João L. Vilaça and Pedro Morais (Facilitators in Break-out rooms)

Introduction to Open Science (18th December 2022) - Online Event

- Topics: definition of Open Science; the importance of Open Science in each research phase; Open Science in the European Union; Open Science in the RUN-EU universities;
- Organization: NHL Stenden;

Building Research Supervisor Capacity (9th and 16th December 2022) - Online Event

- Topics: attracting and selectiing students; getting students off to a good start; helping students plan their research and organising meetings; supporting students' writing; providing effective feedback; preparing for the examination; dealing with challenging situations.
- Organization: TUS;

12. Research Facilities

Barcelos Collaborative Research Innovation Center (B-CRIC)

As already stated in the previous report, IPCA is committed for the construction of a fully dedicated infrastructure for research and innovation, the Barcelos Collaborative Research Innovation Center (B-CRIC). Currently, the public tender to select the construction company and all legal aspects to start with the construction of the infrastructure were already completed. The construction started in February 2023 and its expected to be completed until the end of 2025.

In parallel with the public funding for the B-CRIC, IPCA also guaranteed external funding (with a total funding of 2.352.941,18€) for the construction of a Valorization Innovation Center (VIC). The VIC will be integrated into the B-CRIC infrastructure, aiming to create networks of influence capable of leveraging the integrated development of the region, through bidirectional sharing of knowledge internally or in partnership with companies in the development of applied research and the transfer of knowledge and technology, either through the establishment of licensing agreements, sale or creation of start-up and spin-off companies. The IPCA-VIC is envisioned to be complete during 2023.

National Roadmap for Research Infrastructures

2Ai/IPCA and ID+/IPCA integrated a national consortium (including UAveiro, UCoimbra, ULusófona, UCatólia, AcMilitar, UBeira Interior, UMadeira) which submitted an application to Expression of Interest - National Roadmap of Research Infrastructures call promoted by the Portuguese Foundation for Science and Technology. This proposal, entitled Brain-Machine Interfaces, Neuroprostheses and Associated Devices Infrastructure, exploit the full potential of the already available R&D infrastructures in IPCA aiming to contribute with relevant technological advances in the fields of health (2Ai) and 3D-printing/design (ID+).

Abstract: The area of Brain-Machine Interfaces, Neuroprostheses and Associated Devices [INEAs] is complex, transdisciplinary and rapidly developing. This is a strategic area of enormous importance for the proper positioning of Portugal and Europe in this field of knowledge. For example, the market for brain-machine interfaces is valued at 1.9 billion dollars; expected to grow to 3.3 billion dollars by 2026. In Portugal, there are several research groups working separately on the development of INEAs, however there is still no reference infrastructure that houses all the knowledge associated with this area. Therefore, this new infrastructure aims to integrate multiple research groups in the area of INEAs, in order to maximize the knowledge and results of each of the research groups, transferring this knowledge to clinical, industrial and other applications (such as machine control, gaming, etc.).

Requested Budget for 2Ai: 400.000€

Principal Investigator in 2Ai: João L. Vilaça

Status: Under evaluation

13. Impact Actions and Outreach Activities

Encontro Ciência: The annual meeting of science, technology and innovation in Portugal took place on May 16, 17 and 18, at the Lisbon Congress Center. The program included 6 plenary sessions and 66 thematic sessions that revealed international partnerships of universities, companies, and other national entities. Moreover, it included a set of demonstration sessions, where R&D units and other national scientific infrastructure presented the ongoing projects. 2Ai actively participated in Encontro Ciência through: a large demo of the ongoing projects on health research, namely medical robotics, artificial intelligence, smart systems and automatic diagnosis. Moreover, 2Ai participated through 2 oral and 3 poster presentations. The Encontro Ciência event is organized by the Portuguese Foundation for Science and Technology.

MEDICA fair: MEDICA (Dusseldorf, Germarny) is the world's largest event for the medical sector. For more than 40 years it has been firmly established on every expert's calendar.

There are many reasons why MEDICA is so unique. Firstly, the event is the largest medical trade fair in the world – it attracted several thousand exhibitors from more than 50 countries in the halls. Furthermore, each year, leading individuals from the fields of business, research, and politics grace this top-class event with their presence — naturally alongside tens of thousands of national and international experts and decision-makers from the sector. In 2022, 2Ai integrated the stand from the Health Cluster Portugal, designated "Health Portugal", presenting the main scientific outputs of the ongoing R&D projects. During the fair, it was possible to disseminate the 2Ai research center, as well as, to identify relevant industrial and scientific partners to expand our research ecosystem.

Open Day Industry: Pursuing its strategic plan for 2020-2023, 2Ai/IPCA organized for the first time an open event to promote the discussion between all stakeholders on 2Ai research topics. This event has held at IPCA on the 25th of November 2022 in the Auditorium Eng. António Tavares. The aim of this event was to invite companies to visit IPCA to know our research units, our project and research and technological outcomes to foster new collaborations and knowledge and technology exchange. The event brought to IPCA more than 100 participants from industrial companies, and 14 companies have been awarded for investing in R&D projects developed in collaboration with IPCA. A seminar has also been held about innovation support, and it counted with presentation from ANI (Portuguese agency for innovation) and IAPMEI (Public agency to support small and medium enterprises). The session was opened by the Pro-president for Research and Innovation at IPCA, and by the Vice-President of Polytechnical Institute of Leiria. This event was organized

under the Knowledge Circle project co-promoted by Polytechnical Institute of Leiria and the Polytechnical Institute of Cávado and Ave. More information in: https://knowledgecircle.pt/eventos/.
2Ai members: João L. Vilaça.

On November 23, 2022, researchers from the 2Ai/School of Technology of IPCA promoted two activities, with the themes "LITTLEBITS" and "COLLABORATIVE ROBOTS" at the EB 2,3 Gonçalo Nunes school, Barcelos, within the scope of the Science and Technology week developed by the School of Technology of IPCA.

On October 25, 2022, 2Ai was visited by a group of teachers from 4 European countries (Spain, Croatia, Romania and Turkey) involved in an Erasmus+ project promoted by the Barcelos School Grouping. Visiting professors had the opportunity to visit the 2Ai laboratories and the research work and current projects that are developed by the researchers.

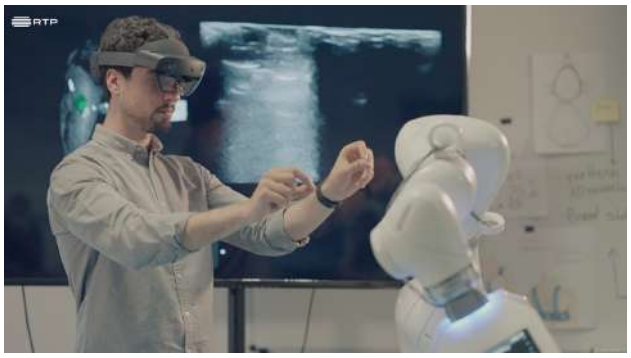
On October 13 to 16, 2022, 2Ai participated in the Concreta 2022 (Concreta, Construction Fair, Rehabilitation, Architecture and Design) at Exponor, Porto.

On September 19 to 21, 2022, 2Ai Laboratory was present at the "Welcome IPCA" event to welcome new students who joined this academic year 2022-2023 at the Polytechnic Institute of Cávado e Ave. It was an intense day, 2Ai Laboratory was also visited by the Minister of Science, Technology and Higher Education, Elvira Fortunato, and by the Secretary of State, Pedro Teixeira.

On September 14, 2022, the 2Ai laboratories were visited by participants from the Group Exploratory Mission (GEM) of Information Technology/Computer Science | RUN-EU and by the Presidents of the institutions which comprise the RUN-EU. Visitors had the opportunity to meet the 2Ai laboratories, the research work and current projects that are developed by the researchers.

On July 6, 2022, within the scope of the Ceremony of Homage to Professor Doctor João Carvalho, 2Ai Laboratory was visited by His Excellency the President of the Portuguese Republic, Professor Marcelo Rebelo de Sousa. The President of the Portuguese Republic visited the 2Ai laboratories and met the research work developed by the 2Ai researchers.

On June 21, 2022, 2Ai Laboratory realized an interview to the TV program “Ensino: O Desafio do Superior em Portugal” from RTP, presenting its R&D goals and impact areas, R&D facilities and ongoing projects. Link: https://www.rtp.pt/play/p10505/e631016/ensino-o-desafio-do-superior-em-portugal



On June 2, 2022, 2Ai Laboratory was visited by the participants of the International Computer Programming Education Conference (ICPEC) which takes place on the 2nd and 3rd of June 2022 at the School of Technology in IPCA, Barcelos, Portugal. Participants had the opportunity to meet the research areas and projects developed by 2Ai Laboratory.

On May 25t, 2Ai researchers realized an interview for the TV program “Falar Global” from CMTV, presenting the ongoing projects. Link: https://www.cm-tv.pt/programas/informacao/falar-global/detalhe/ciencia-2022-tres-dias-de-partilha-de-projetos-para-o-futuro?ref=FalarGlobal_DestaquesPrincipais

On May 16, 2022, 2Ai laboratory was visited by students from 4 European countries (Portugal, Ireland, Austria and Netherlands) that are attending the RUN-EU Short Advanced Program (SAP) with the theme “Challenging Game Development”. This RUN-EU Short Advanced Program (SAP) is coordinated by the Polytechnic Institute of Cávado and Ave (IPCA) and NHL Stenden University of Applied Sciences (NHL Stenden).

On May 10 and 11, 2022, 2Ai Laboratory was visited by students from secondary schools of four districts (Braga, Porto, Vila Real and Viana do Castelo) within the scope of the Open IPCA 2022 event promoted by Polytechnic Institute of Cávado and Ave (IPCA). The Open IPCA 2022 received more than 1000 secondary school students. Visitors had the opportunity to meet the 2Ai laboratories and the research work developed by the researchers.

On March 29, 2022, 2Ai Laboratory was visited by the students of the Clube de Ciência Viva from Rosa Ramalho School, Barcelos. Visitors had the opportunity to participate in the workshop with the theme "Inteligência Artificial e Jogos Digitais" promoted by Professor Alberto Simões, followed by a visit to the 2Ai laboratories guided by Professor Fernando Veloso. Finally, the students carried out an activity with the theme "LITTLEBITS" promoted by researchers João Faria and Helena Correia.

On March 18, 2022, 2Ai Laboratory was visited by the Erasmus students from five European countries (Germany, France, Italy, Romania and Poland) within the scope of the "Fit for Life" project promoted by the Rosa Ramalho School, Barcelos. Visitors had the opportunity to meet the 2Ai laboratories and the research work developed by the researchers.

On March 10, 2022, 2Ai Laboratory was visited by the Erasmus students from five European countries (Spain, Italy, Belgium, Czech Republic and Hungary) within the scope of the "GAMIFIED" project promoted by the Esprominho Vocational School, Braga. Visitors had the opportunity to meet the 2Ai laboratories and the research work developed by the researchers. The visit was marked by the enthusiasm and

interest shown by the Erasmus students.